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REVIEW
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SERIES A.

VOL. 33. 1945.

SMITH (F. F.) & BRIERLEY (P.). *Ornithogalum* **Mosaic.**—*Phytopathology* **34** no. 5 pp. 497–503, 1 fig., 3 refs. Lancaster, Pa., 1944.

The following is mainly based on the authors' summary. A mosaic disease observed in *Ornithogalum* from Oregon and Alabama is described, and the name *Marmor scillearum*, sp. n., is proposed for the virus. It was transmitted with difficulty by sap, with high efficiency by *Aphis gossypii*, Glov., *Macrosiphum lilii*, Monell, *M. solanifolii*, Ashm., and *Myzus persicae*, Sulz., and with somewhat lower efficiency by *Myzus circumflexus*, Buckt. Viruses indistinguishable from it, at least in *Ornithogalum*, were found in naturally infected plants of hyacinth (*Hyacinthus orientalis*) and *Galtonia candicans* from Oregon and *Lachenalia* sp. from Alabama, and were transmitted to *Ornithogalum* from all these plants by *M. persicae* and from hyacinth by *Macrosiphum solanifolii*. Attempts to transmit the virus to plants of other genera were unsuccessful, except for a doubtful infection in *Eucomis undulata*, which, like the proved hosts, belongs to the tribe Scilleae of the Liliaceae.

BRIERLEY (P.) & SMITH (F. F.). **Studies on Lily Virus Diseases : the necrotic-fleck Complex in** *Lilium longiflorum*.—*Phytopathology* **34** no. 6 pp. 529–555, 11 figs., 23 refs. Lancaster, Pa., 1944.

Details are given of experiments in the United States from which it appears that the necrotic-fleck disease of Easter lily (*Lilium longiflorum*) is due to concurrent infection with cucumber-mosaic virus [*Marmor cucumeris* of Holmes] and a lily symptomless virus (LSV) for which the name, *Adelonosus lillii*, gen. et sp. n., is proposed ; that mottle viruses (LMV) consistently associated with necrotic fleck in commercial Easter lilies are not an essential part of the complex ; and that *Aphis gossypii*, Glov., is a specific vector for LSV and therefore for the complex CV (cucumber-mosaic virus)+LSV. When transferred from flecked lilies to virus-free seedlings, *A. gossypii* transmitted necrotic fleck, *Macrosiphum solanifolii*, Ashm., and *Myzus persicae*, Sulz., transmitted CV and LMV but not fleck, and *Aphis fabae*, Scop., *Macrosiphum lilii*, Monell, *Myzus circumflexus*, Buckt., and *Macrosiphum solani*, Kalt. (*Myzus convolvuli*, Kalt.) did not transmit any virus. Necrotic fleck was produced by Aphid (but not sap) transmission of LSV to lilies infected with CV, and by Aphid or sap transmission of CV to symptomless lilies infected with LSV.

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LSV was compared with lily-rosette virus in some experiments. Both were of the persistent group, having latent periods of 4–6 and 3–7 days, respectively, in *A. gossypii*, but LSV did not protect Easter lilies from infection with lily-rosette virus. The latent period permits the separation of LSV from LMV.

Tests of host range indicated that LSV is confined to Easter lily, though the susceptibility of tulip, *Colchicum* and *Gloriosa* remained in doubt. No evidence of susceptibility to this virus was found in the other plants tested, which comprised 56 species representing 40 genera, including *Lilium*, and 9 families, chiefly Monocotyledons. *A. gossypii* transmitted CV from necrotic-flecked Easter lilies to *Calochortus* sp., *Colchicum autumnale*, *Gloriosa rothschildiana* and *Fritillaria pudica*, not previously recorded as susceptible to this virus.

Smith (F. F.) & Brierley (P.). **Preliminary Report on some Mosaic Diseases of Iridaceous Plants.**—*Phytopathology* **34** no. 6 pp. 593–598, 1 fig., 6 refs. Lancaster, Pa., 1944.

The following is based on the authors' summary and discussion of investigations in progress on mosaic viruses found in certain genera of Iridaceae in the United States. The virus of mosaic of *Tigridia* was found to be transmissible by *Aphis gossypii*, Glov., *Macrosiphum lilii*, Monell, and *Myzus circumflexus*, Buckt., but not by sap; gladiolus-mosaic virus was transmissible by *M. circumflexus* and *M. persicae*, Sulz., but not by sap. Virus was transmitted from mottled *Babiana*, *Ixia*, *Sparaxis*, *Streptanthera*, *Tigridia*, and *Watsonia* to *Tritonia crocata* by *M. persicae*.

Cucumber-mosaic virus [*Marmor cucumeris* of Holmes], which had not previously been recorded from Iridaceae, was found in *Sparaxis* hybrids. It is thought that it may contribute to the effects of the mosaic of *Sparaxis*, but that it is not the only virus concerned. It is uncertain whether or not the mosaics in *Gladiolus*, *Tigridia* and some other Iridaceae are caused by a common virus.

Report of Progress for Year ending June 30, 1943.—*Bull. Maine agric. Exp. Sta.* no. 420 pp. 419–587, 6 figs., refs. Orono, Me., 1943.

This report contains notes by various authors on the insect pests of crops in Maine in 1942. Sprays and dusts containing derris were tested on potatoes against *Myzus persicae*, Sulz., *Aphis rhamni*, Boy. (*abbreviata*, Patch), *Macrosiphum solanifolii*, Ashm., and *M. solani*, Kalt. (*Myzus pseudosolani*, Theo.), which are the Aphids concerned in the transmission of leaf-roll [*Corium solani* of Holmes]. Control on the plots treated with the sprays throughout the season was rather unsatisfactory (14–76 per cent.) and the increase in yield was not encouraging, but the poor results are attributed in part to inadequate spraying equipment. The dusts gave 91–95 per cent. control and increased the yield by 17·3–47·5 per cent. In preliminary tests of a number of insecticides combined with a neutral copper fungicide, a spray containing derris and soybean oil gave the greatest reduction in infestation 2–3 days after a single application, and one containing derris and nicotine sulphate was also very effective.

Over 92,900 alate Aphids were caught in one trap during the season; there was little difference in the numbers taken at various heights up to 26 ft. above the ground. A short distance between fields therefore affords little protection to potatoes grown for seed from Aphids flying from other potatoes in the vicinity. Wild plums, on which *Myzus persicae* overwinters in the egg stage, were found to be abundant in north-eastern Maine, but chiefly in easily accessible situations. The Aphids were numerous on these trees in early June, when they migrated to young potato plants and weeds, notably those known locally as mustard and kale [*Brassica compestris* and *Raphanus raphanistrum*], on which they bred until the end of July [*cf. R.A.E.*, A **31** 251]. A migration from the

weeds to potato then occurred, resulting in considerable spread of leaf-roll. In a greenhouse experiment, an average of 2,517 alates of *M. persicae* developed on single plants of *B. campestris*, on each of which one Aphid was originally placed ; it is therefore important that weeds should be destroyed while still in the seedling stage. Alates of this species were produced earlier and more abundantly on the one of two varieties of potato in which the plants and the area of leaf surface were the smaller.

The area infested by the European corn borer [*Pyrausta nubilalis*, Hb.] extended slightly. Large numbers of adults emerged during June and July ; emergence of the single-brooded strain began first and overlapped that of the two-brooded strain. Limited data obtained in the autumn indicated that the larvae may leave the maize stalks late in the season, particularly those that are crushed or broken, and seek other hibernation quarters. Farm premises should therefore be cleared of maize refuse, weeds and other shelter each autumn and spring. Studies over a period of two years showed that the larvae migrate downwards in the maize stalks when cold weather sets in ; about 2 per cent. were found below the first node, about three inches from the soil, the majority between the first node and the point of attachment of the ear, and a few above the point of attachment or in the ear itself.

Infestation of beans by the Mexican bean beetle [*Epilachna varivestis*, Muls.] was the heaviest yet recorded in some areas of Maine, and many new areas became infested. Overwintered adults were feeding on 5th June, when the plants were small, and injury was consequently very severe. The larvae began to feed soon afterwards, and the majority continued until autumn, when they completed their development to adults ; a few became adult in August and gave rise to a second generation. In experiments on control, the highest yield was given by plants treated with a dust containing 1 part calcium arsenate and 7 parts of a mixture of copper sulphate and lime containing magnesium, which was very slightly more effective than a similar dust in which the magnesium lime was replaced by calcium [magnesium-free] lime [*cf.* **30** 447]. The yields from plots dusted with pyrethrum (3 per cent. pyrethrins), mixtures of cryolite and flour (1 : 3) or calcium arsenate and magnesium lime (1 : 10), and a derris dust (0·75 per cent. rotenone) were rather lower and fairly equal. That from plots treated with a mixture of calcium arsenate and magnesium lime (1 : 7) was lower, but twice that obtained when calcium lime was substituted for magnesium lime, which was less than the yield from untreated plots. A derris spray resulted in only a small increase. From these and previous experiments, it is concluded that a dust of copper sulphate, magnesium lime and calcium arsenate is one of the most satisfactory materials for use against *E. varivestis* on beans, and that cryolite also shows promise. Neither should be applied after the pods have set unless residues are to be removed. Beans slightly infested by *Bruchus* (*Acanthoscelides*) *obtectus*, Say, remained free from noticeable injury when stored at temperatures that did not exceed 50°F. and frequently fell below 30°F.

A fairly widespread outbreak of *Phenacoccus aceris*, Sign., which had hitherto been only locally injurious, occurred in apple orchards in central Maine. As a result of the attack, leaves, fruits and branches became covered with a sooty deposit that could only be removed from the harvested fruits by washing and wiping each one individually. Dusts containing 25 and 15 per cent. lead arsenate in dusting sulphur were compared against *Rhagoletis pomonella*, Walsh, on apple. The arsenic deposit from the stronger dust was the greater, and this was apparently due to better adhesion as well as to the greater initial deposit. The amount of arsenic deposited by known amounts of dust varied considerably, probably largely with weather conditions at the time of application. In one instance, the increase in deposit was considerable on leaves dusted when wet with dew and not detectable on others dusted when they had dried. The stronger dust was the more effective against *R. pomonella*, but control was

not complete on trees near an infested and neglected orchard. Infestation of apples by *Conotrachelus nenuphar*, Hbst., decreased in late summer in orchards under observation, and by autumn was the lowest recorded for five years. The dusts tested against *R. pomonella* were also used against *Lymantria* (*Porthetria*) *dispar*, L., on apple, but the deposit of arsenic was not sufficient to give complete control. The deposit on the foliage at different dates during the season was roughly proportional to the amount of arsenical dust applied, and there was little accumulation during the season, the quantity decreasing soon after each application, probably owing to rainfall. *Paratetranychus pilosus*, C. & F., has increased rapidly in commercial orchards in recent years, and this is attributed in part to favourable weather conditions and in part to the increasing use of mild sulphur sprays and dusts instead of lime-sulphur in summer.

Dusts for the control of the blueberry fruit-fly [*R. pomonella*], were applied at the rate of 6 lb. per acre on 9th, 17th and 25th July. The average numbers of larvae per 20 oz. fruit treated with calcium arsenate, two proprietary pyrethrum dusts and a cryolite dust were 2, 6·5, 7·5 and 9·3, respectively. Plants treated with calcium arsenate were severely defoliated, and the fruits were smaller and more dropped than on the other plots, on which the foliage was in excellent condition at harvest.

WILL (H. C.). **Notes and News on Sawfly Larvae in Pennsylvania.**—*Proc. Pa Acad. Sci.* **18** pp. 48–49. [Harrisburg, Pa.] 1944.

Records are given of recent instances of infestation of dogwood (*Cornus*), including a cultivated variety of *C. stolonifera*, by *Macremphytus varianus*, Norton, and the adult and larva of this sawfly are described. It does not appear to attack flowering dogwood [*C. florida*].

Diprionine larvae of a partial second or third brood were found on pines in a nursery in October 1943. They comprised *Neodiprion lecontei*, Fitch, on white, Scots and Mugho pines [*Pinus strobus*, *P. sylvestris* and *P. mugo*] and *Diprion similis*, Htg., on Mugho pines only. *M. varianus* and *D. similis* have not previously been recorded in Pennsylvania ; recent observations show that *N. lecontei* is widely distributed there.

HAYWARD (K. J.). **Departamento de Entomologia.** [Department of Entomology (Report for 1942 of the Tucumán Experiment Station).]—*Rev. industr. agric. Tucumán* **33** no. 4–6 pp. 66–84, 1 fig. Tucumán, 1943.

The routine work carried out during the year is reviewed and records are given of the numerous pests observed, many of which have been noticed from previous reports [*R.A.E.*, A **31** 41, etc.] or from other sources [**30** 423 ; **31** 444 ; **32** 13]. Most of the pests of *Citrus* were less injurious than usual, but *Coccus* (*Lecanium*) *deltae*, Lizer, much extended its range, and caused more damage than ever before. The other Coccids observed included *Hemiberlesia rapax*, Comst., which was found on orange, from which it had not previously been recorded in Tucumán. An outbreak of the black citrus aphis, *Toxoptera aurantii*, Boy., occurred in late winter and early spring, but it was soon controlled by natural enemies, of which the chief was *Aphidius platensis*, Brèth. Pests on other fruit crops included *H. rapax* on vines, *Anastrepha pseudoparallela*, Lw., on *Passiflora edulis*, *Pinnaspis aspidistrae*, Sign., on cherimoya [*Annona cherimolia*], and *Capitophorus fragaefolii*, Ckll., on strawberry.

Potato was attacked by *Agrotis ypsilon*, Hfn., *Gnorimoschema operculella*, Zell., which had only recently been recorded in Tucumán [**31** 41], but was found to be widely established there, the weevil, *Rhigopsidius tucumanus*, Heller, which caused more injury to the tubers than usual, and *Scaptocoris terginus*, Schioedte, a Cydnid that attacks the roots of various plants and has been recorded on tomato and *Capsicum* in Argentina and on rice, cotton and peas in Brazil, but not previously on potato.

Rodriguez L[ope]z (L.). **La plaga de langostas en la Provincia de Imbabura.** —*Bol. Dep. Agric. Ecuador* no. 14, 18 pp., 5 figs. Quito, 1942. [Recd. 1944.]

Schistocerca americana, Drury, is common in the coastal areas of Ecuador, where it is of no economic importance, except occasionally in some cotton-growing areas of the Manabi province. It also occurs in the provinces of Carchi and Imbabura. In the latter, some swarms of *S. paranensis*, Burm., have also appeared recently, but were restricted to uncultivated areas.

A description of the stages in the development of a locust is given, and the usual methods of control recommended.

Nepveu (P.). **Les différences de pouvoir parasitaire du pou de San José (*Quadraspidiotus perniciosus* Comst. Coccidea), selon les végétaux.**—*C.R. Acad. Sci.* **216** no. 18 pp. 612–614, 2 refs. Paris, 1943.

An investigation was made in southern France of the ability of *Quadraspidiotus perniciosus*, Comst., to infest some 200 species of wild and cultivated plants. The crawlers attached themselves to almost all the ligneous plants offered, whether or not they were able to complete development on them. It was found that the plants studied could be divided into three overlapping groups, those on which the Coccid maintained its numbers or increased in successive generations, those on which it bred but died out in the course of a few generations, and those on which no adult females could be found. Typical examples of each group are cited; those of the first included, besides the well-known fruit-trees, *Citrus trifoliata*, *Cornus sanguinea*, privet (*Ligustrum vulgare*) and species of *Cotoneaster*, *Crataegus*, *Cytisus*, and, to a somewhat less degree, *Cistus*.

Allgemeine Verhandlungen. [General Transactions.]—*Verh. 7. int. Kongr. Ent., Berlin 1938* **3** pp. 1427–1552. Weimar, 1939. [Recd. 1944.]

The papers in this section [*cf.* also *R.A.E.*, A **28** 40, 256], many of which contain information that has been noticed from other sources, include: **Die wichtigsten Probleme der angewandten Entomologie Jugoslaviens** [The most important Problems of applied Entomology in Jugoslavia], pp. 1480–1487, in which M. Gradojević gives very brief notes on several pests of importance in agriculture and forestry, with lists of others; **Die Organisation des Pflanzenschutzes in Polen** [The Organisation of Plant Protection in Poland], pp. 1488–1493, in which J. Ruszkowski describes the organisation and functions of the official bodies concerned with the development of plant protection in that country; **Landwirtschaftliche Entomologie in Peru und angrenzenden Ländern Südamerikas** [Agricultural Entomology in Peru and neighbouring countries in South America], pp. 1523–1539, 15 refs., in which J. E. Wille reviews the more important insect pests of crops in the three geographical regions into which Peru is divided; **Three Years' Progress in the Studies of economic Entomology in Egypt,** pp. 1540–1552, in which M. S. el Zoheiry refers briefly to work completed in recent years or still in progress on the control of various insect pests of crops and stored products in Egypt, with notes on apiculture, sericulture and quarantine work; and **Libellen als Objekte der angewandten Entomologie** [Dragonflies as Subjects of applied Entomology], pp. 1494–1505, 1 pl., 50 refs., by E. Schmidt. This is a review of the literature, from which it appears that dragonflies are harmful since they destroy honey-bees and small fish, particularly trout, and transmit Trematodes of the genus *Prosthogonimus* to fowls that feed on them, but are also beneficial since they serve as food for fish and destroy various blood-sucking Diptera and apparently also some insect pests of plants.

Bienen- und Seidenzucht. [Bee-keeping and Silk Production.]—*Verh. 7. int. Kongr. Ent., Berlin 1938* **3** pp. 1735–1904. Weimar, 1939. [Recd. 1944.]

The papers in this section include : **Die Wirkung neuerer Schädlingsbekämpfungsmittel auf die Bienen** [The Effect of the newer Insecticides on Bees], pp. 1746–1758, 1 pl., 7 graphs, 11 refs., in which F. K. Böttcher describes experiments that have been noticed from more detailed accounts [*R.A.E.*, A **27** 101, 231, 402] ; and **Apicoltura e Fitoterapia** [Apiculture and Phytotherapy], pp. 1896–1904, 17 refs., in which A. Zappi Recordati discusses the danger to bees that is involved in spraying fruit trees with arsenicals while they are in bloom, and points out that it can be avoided in the region of Verona, as sprays against *Cydia pomonella*, L., on apple need not be applied before the peak of emergence of the overwintered generation and this occurs after petal-fall [*cf.* **22** 250, etc.]. In **Obstbaumspritzung und Bienenhaltung** [Fruit-tree Spraying and Bee-keeping], pp. 1845–1850, E. L. Loewel states that as bees were found essential for fruit production on the Lower Elbe and suffered considerable mortality from arsenical sprays, and possibly from sprays containing copper compounds, applied while the trees were in bloom, the use of such sprays during this period was forbidden in 1938. Spraying in spring with a tar distillate or with dinitro-o-cresol, which was thought to have a repellent effect on bees during blossoming, had no effect on them.

In **Honigtau, Bienenzucht und Forstwirtschaft** [Honey-dew, Bee-keeping and Forestry], pp. 1778–1791, 3 pls., 1 fig., 6 refs., B. Geinitz points out that the honey-dew produced by various species of *Cinara* (*Lachnus*, auct.) on conifers is an important source of honey for bees in several parts of Germany [*cf.* also **31** 28]. The effect of climate and natural enemies on these Aphids, which do no harm to their food-plants, is briefly discussed.

In **Totenkopf-Schmetterlinge und ihre Beziehung zur Bienenzucht** [*Acherontia atropos* and its Relation to Bee-keeping], pp. 1817–1829, 7 pls., 39 refs., J. Koppán gives an account of the habits of *Acherontia atropos*, L., which enters bee-hives to steal the honey and has proved a nuisance in Hungary. The moths are not injured by bee-stings, but are sometimes crushed to death by the bees. They can be prevented from entering the hives by covering the entrances with suitable grilles. In **Die *Acarapis*milben auf der Honigbiene** [*Acarapis* Mites on the Honey Bee], pp. 1872–1878, Z. Örösi-Pál describes experiments showing that mites of the genus *Acarapis* that live externally on bees feed on their haemolymph irrespective of the thickness of the integument. Two species of these mites have been distinguished according to the site of infestation [*cf.* **23** 185], but the morphological characters distinguishing them and the form that lives in the tracheae [*loc. cit.*] overlap to some extent, and the author has found mites on still other parts of the bodies of bees, notably the dorsum of the first abdominal segment, in Germany and Hungary.

Forstentomologie. [Forest Entomology.]—*Verh. 7. int. Kongr. Ent., Berlin 1938* **3** pp. 1905–2171. Weimar, 1939. [Recd. 1944.]

The papers in this section [*cf.* also *R.A.E.*, A **28** 320] include : **Exkremente und Bohrmehl forstschädlicher Insekten** [Excreta, Frass and Débris due to Boring by Forest Insect Pests], pp. 1930–1940, 5 pls., 3 refs., by K. Eckstein [*cf.* **27** 391, 568] ; **Populationsdynamik des Kiefernspanners in verschiedenen Biotopen** [Dynamics of the Population of the Pine Geometrid (*Bupalus piniarius* L.) in different Biotopes (in Germany)], pp. 1941–1949, by H. Engel [*cf.* **30** 615] ; **Ueber die Ernährungsverhältnisse der Hornmilben (Oribatiden) und ihre Bedeutung für die Prozesse im Waldboden** [The Contents of the Food of Oribatid Mites and their Effect on the Processes that occur in Forest Litter], pp. 1950–1957, 2 pls., by K. H. Forsslund ; **Das massenhafte Vorkommen des Kiefernschwärmers** *Sphinx pinastri* **L. in Polen** [The mass Occurrence of the Pine

Sphingid, *S. pinastri*, in Poland], pp. 2033–2051, 1 pl., 3 graphs, 15 figs., 13 refs., by M. NUNBERG [*cf.* **27** 676] ; **Ueber Forstschädlingsauftreten in der Türkei** [The Occurrence of Forest Pests in Turkey], pp. 2105–2131, 26 refs., by E. SCHIMITSCHEK [*cf.* **30** 244] ; **Die Organisation der Schädlingsbekämpfung in den Preussischen Staatsforsten** [The Organisation of the Control of Pests in the State Forests of Prussia], pp. 2132–2148, 5 refs., by F. SCHWERDTFEGER ; **Identification of Indian Forest Insects,** pp. 1958–1962, 1 pl., 2 refs., in which J. C. M. GARDNER emphasises the importance of rapid identification of forest insects in India and the value of the systematic classification of immature stages, particularly the larvae of Coleoptera and Lepidoptera ; and **Insektenkalamitäten in den niederländischen Forsten** [Insect Outbreaks in Netherlands Forests], pp. 2011–2020, in which M. de KONING surveys the history and organisation of silviculture in Holland, enumerates the major outbreaks of insect pests that have occurred since 1807, and reviews the control measures that have been applied against the more important ones.

In **Ueber den Stand der Forstschädlinge und die Versuche zur Bekämpfung des Waldmaikäfers** (*Melolontha hippocastani* **L.**) **in Lettlands Staatsforsten** [The Situation as regards Forest Pests and Experiments in the Control of the Forest Cockchafer (*M. hippocastani*, F.) in State Forests in Latvia], pp. 1907–1921, 4 pls., 1 map, 18 refs., L. BRAMMANIS, in addition to the information already noticed [**28** 8 ; **29** 86], states that burning heather on land infested with *Melolontha hippocastani*, F., did not affect the larvae but killed many of the adults if it was done just before their emergence from the soil ; and that though thorough cultivation before reafforestation reduces oviposition by this species [*cf.* **27** 299 ; **28** 8], it would apparently be ineffective against *M. melolontha*, L. (*vulgaris*, F.) as in Latvia the larvae are sometimes abundant in cultivated soil.

Untersuchungen an Viruskrankheiten einiger Forstinsekten [Investigations on Virus Diseases of some Forest Insects], pp. 1963–1973, 4 pls., 1 ref., by E. HEIDENREICH, consists chiefly of details of the results of histological examination of the infected insects. The diseases discussed are polyhedral disease of the larvae of the nun moth [*Lymantria monacha*, L.], another disease of the pupae, a disease of larvae of the Tenthredinid, *Lyda stellata*, Christ, that have entered the soil for hibernation, and a disease of the larvae of *Melolontha hippocastani*, F., and *M. melolontha*, L. (*vulgaris*, F.) which the author calls " water infection " (Wassersucht), as the fat-body of the larva degenerates into a fluid.

In **Die Bedeutung des Optimums für den Massenwechsel forstschädlicher Insekten** [The Importance of the Optimum for the Variation in Abundance of Forest Insect Pests], pp. 1974–1989, 1 pl., 9 graphs, E. JANISCH reviews evidence in support of his theory that outbreaks of an insect pest depend on environmental conditions, that any particular insect has a hereditarily fixed optimum temperature at which it is most resistant to other adverse factors, and that this temperature is the same as the one at which it develops most rapidly, and so can be ascertained by the use of a catenary curve to express the results of laboratory observations on the effect of temperature on rate of development [*cf.* **18** 241 ; **19** 651 ; **21** 378 ; **27** 98, 564 ; etc.].

In **Ueber die Widerstandsfähigkeit der Fichte gegen Angriffe von** *Dendroctonus micans* [On the Resistance of Spruce to Attack by *D. micans*], pp. 1990–2004, 1 pl., 9 figs., 7 refs., E. KANGAS states that Trägårdh's method of entomological analysis of trees [**15** 271] was used in 1938 to ascertain the causes of withering of spruce that had occurred in south-eastern Finland over a period of ten years. The results showed that *Dendroctonus micans*, Kug., was the most injurious of the many beetles that infested the trees, and usually attacked completely healthy trees. The next in importance was the weevil, *Pissodes harcyniae*, Hbst., which was also a primary pest, though it sometimes attacked trees initially injured by *D. micans*. The presence of such secondary pests as *Tetropium fuscum*, F., and *T. castaneum*, L., indicated that the tree was about to dry up completely. It was also found that though a spruce tree does not long survive severe

infestation by *D. micans* or concurrent infestation by *D. micans* and *P. harcyniae* or a fungous disease, it can withstand a comparatively mild infestation by *D. micans* for two or three years without showing any signs of reduced vigour. This resistance to *D. micans* is of practical importance, as the mildly infested trees are overlooked during selective felling and act as breeding places for other bark-beetles ; it also explains why trees in a stand continue to wither over a long period.

In **Eine neue biologische Kontrolle der Forstschädlinge** [A new biological Method of recording Forest Pests] pp. 2005–2010, J. Komárek & A. Pfeffer give an account of the successful employment in forests in Czechoslovakia of Dyk's method of using females of *Lymantria monacha*, L., to attract and trap the males and so estimate the abundance of the moth [*cf.* **26** 659]. The authors consider that such an estimate is valid, since the sexes occur in about equal numbers, and that the method is superior to older ones, which are outlined [*cf.* **22** 429]. One box contaning a single female was sufficient for 2½–7 acres of forest; the female and the strips of adhesive paper to trap the males were renewed every five days from mid-July to the end of August. The numbers of males caught in this way averaged 144 per acre in a spruce stand covering an area of some 356 acres, over which 45 boxes were used with a total of 357 female moths. The same method was also found effective for *Lymantria* (*Liparis*) *dispar*, L., and *Nygmia phaeorrhoea*, Don. (*Liparis chrysorrhoea*, auct.). In the discussion that followed, J. M. Rašek pointed out, on the basis of experiments with *L. monacha* in Moravia, that Dyk's method is of value if the moths are healthy but not if they have been affected by polyhedral disease or by abnormal weather during development. H. W. Nolte stated that it failed to afford data for estimating the abundance of the moth in Saxony in 1937 and 1938 [*cf.* **30** 540]. The males were caught in much smaller numbers when the infestation was severe, probably because of the greater number of free females to offset the attractiveness of the caged ones. H. Mors pointed out that the method of survey evolved by Wellenstein in East Prussia [**24** 750] was very effective and cheaper than Dyk's method, and that the latter method did not give a true index of the intensity of infestation there, as the numbers of males caught showed no constant relation to the abundance of the female moths in a stand.

In **Zur Biologie des Puppenräubers** (*Calosoma sycophanta* **L.). Seine Bedeutung als Feind unserer Forstschädlinge** [Contribution to the Biology of the pupal Predator (*C. sycophanta*). Its Importance as an Enemy of our Forest Pests], pp. 2021–2032, 11 refs., H. W. Nolte gives an account of the bionomics of *Calosoma sycophanta*, L., as observed in Saxony in 1937 and 1938 [*cf.* **27** 170], with special reference to the desirability of its organised use for the control of *Lymantria monacha*, L., and other forest pests. He estimates that one pair and its progeny could destroy about 3,700 larvae of *L. monacha* in a season [*cf.* also **17** 5: 6]. As the polyphagous habits of this Carabid should facilitate its mass breeding, he gives a list, based on the literature and his own laboratory experiments, of about 20 species of Lepidoptera and sawflies on the larvae of which it feeds. He also gives notes on methods of breeding it on a small scale and on the effect on the larvae and adults of dust insecticides used against forest pests. The practicability of its mass breeding for the control of forest pests was disputed in the discussion that followed.

Die Populationsdynamik einiger kanadischer Blattwespen [The Dynamics of the Population of some Canadian Sawflies], pp. 2052–2104, 13 figs., 48 refs., by K. E. Schedl, is an account of investigations in Quebec and Ontario in 1930–31 of the relative importance of the various factors that affect the abundance of *Neodiprion nanulus*, Schedl, *N. rugifrons*, Midd. (*dubiosus*, Schedl), and *N. swainei*, Midd., on *Pinus banksiana* [*cf.* **25** 725]. The biotic potential of each species and the controlling effect of the environment on each stage are discussed in detail, the factors concerned being parasites, predators (notably

birds that destroy the feeding larvae), weather conditions, and also unknown causes in the case of eggs. Keys are given for distinguishing the eggs of the three species and for separating healthy eggs, eggs that have hatched normally, eggs that are parasitised or from which parasites have emerged, and unparasitised or parasitised eggs that have been destroyed by Hemiptera. Details are given of the bionomics and interrelation of the two eggs parasites, *Closterocerus cinctipennis*, Ashm., and *Tetrastichus* sp., and brief notes on seven parasites of the larvae. *Closterocerus* and *Tetrastichus* were reared from eggs of *N. swainei* and *N. dubiosus*; the few parasites from eggs of *N. nanulus* were not identified. The sawfly populations were in a state of balance during the study, and the mortality percentages caused by the various factors during successive stages of development are analysed in detail to show the significance of each and afford a basis for forecasting risks of outbreaks.

Lebensweise und Bekämpfung des Maikäfers. [Habits and Control of the Cockchafer.]—*Verh. 7. int. Kongr. Ent., Berlin 1938* **3** pp. 2173–2276. Weimar, 1939. [Recd. 1944.]

The cockchafers that are the subject of this section are exclusively *Melolontha melolontha*, L., and *M. hippocastani*, F. The papers in it [*cf.* also *R.A.E.*, A **27** 299] include: **Neue praktische Erfahrungen in der Maikäferbekämpfung in Schleswig-Holstein** [New practical Experiences in Cockchafer Control in Schleswig-Holstein], pp. 2201–2205, by W. Ext [**27** 171]; **Der Stand der Maikäferfrage in Polen** [The Status of the Cockchafer Question in Poland], pp. 2206–2214, 4 pls., by A. Kozikowski [**27** 676]; and **Freilanduntersuchungen zur Biologie des Maikäfer-Engerlings** (*Melolontha hippocastani* **F.**) [Field Investigations on the Biology of the Cockchafer Larva (*M. hippocastani*)], pp. 2241–2252, 2 pls., 1 ref., by F. Schwerdtfeger [*cf.* **27** 606].

In **Ueber die Ursachen des Massenwechsels von** *Melolontha melolontha* **L.** [Causes of the Variation in Abundance of *M. melolontha*], pp. 2175–2189, 1 pl., H. Blunck, on the basis of the literature and work carried out since 1934 at Kiel and Bonn, reviews the external factors that limit or favour the mass occurrence of *M. melolontha* in Germany, those discussed being temperature, which particularly affects the adults, wind which affects their flight, high humidity and floods, which kill the larvae [*cf.* **26** 521], natural enemies and diseases [*cf.* **27** 100, 496], and finally changes in the character of the biotope by human activity. He concludes, however, that too little is known of its ecology to afford a full explanation of the fluctuations in its abundance and to grade the factors according to their importance. Preventive control should continue, and it is advisable to pollard trees during the winter preceding a flight year and to cut back to the ground all shrubs that are not useful in order to deprive the beetles of food.

In **Ueber die klimatische Bedingtheit des Zusammenbruches von Massenvermehrungen beim Maikäfer** [The Dependence on climatic Conditions of the Collapse of Mass Increases of the Cockchafer], pp. 2190–2200, 1 pl., 2 figs., 5 refs., F. Eckstein maintains the view that climatic conditions are the primary factors that are responsible for sudden outbreaks of bacterial or fungous diseases among larvae and adults of the cockchafer [*M. melolontha*] such as occurred in different parts of Germany in 1937 and 1938, since they affect the susceptibility of the larvae, the density of the population, and the physical and chemical properties of the soil. The type of the vegetation and the effect of cultivation must also be considered. Further research on the interrelation of these and other factors is required to work out a reliable basis for effective control.

Die Maikäferbekämpfung an der Bergstrasse im Mai 1938 (*Melolontha melolontha* **L. und** *M. hippocastani* **F.**) **(Vorläufiger Bericht)** [Cockchafer Control in the Bergstrasse Region in May 1938 (Preliminary Report)], pp. 2215–2223,

1 map, by K. Küthe, is a detailed account of the organised large-scale collection of the adults of *Melolontha* spp. by jarring them from the trees on which they were feeding [*cf.* **23** 594], carried out in the Bergstrasse region [*cf.* **30** 576] from 6th to 20th May 1938. Some 18 million beetles were destroyed, and it is estimated that they represented from 8 to 31 per cent. of the total numbers that appeared in the different districts, and that the cost of the campaign was equivalent to only 5–7 per cent. of the annual loss caused by cockchafer larvae in the area.

In **Massenanschwemmungen von Maikäfern an der deutschen Ostseeküste während des Fluges 1938** [Mass Drifts of Cockchafers on the German Coast of the Baltic during the Flight in 1938], pp. 2224–2230, 1 map, 1 pl., 2 refs., E. Meyer gives details of observations in June 1938, when millions of adults of *Melolontha* spp. were stranded at various points along practically the whole coast of Schleswig-Holstein and Mecklenburg. Swarms of beetles had been observed flying out to sea and eventually falling into the water, and the fact that this took place in calm weather with only a slight wind, indicated that the flight was voluntary, while the presence of both sexes and of females in all stages of ovarian development showed that it was a migration and not a search of sites for oviposition. Most of the stranded beetles soon recovered and flew away. In laboratory experiments at Kiel, beetles in water with a salt content of 1·5 per cent. suffered 50 and 100 per cent. mortality in 24 and 48 hours, respectively.

In **Unterschiede im Schwärmverlauf von** *Melolontha hippocastani* **F. und** *M. melolontha* **L.** [Differences in the Course of the Swarming of *M. hippocastani* and *M. melolontha*], pp. 2231–2240, 2 graphs, 1 map, W. Neu records observations in April–June 1938 in part of the Bergstrasse Region where *M. melolontha* was widely distributed and *M. hippocastani* occurred locally. The mass-flights of *M. hippocastani* and of *M. melolontha* began on 3rd and 4th May, respectively, and ended on 9th June, and females with mature or almost mature eggs occurred from 15th May onwards. The flight of *M. hippocastani* always began and finished earlier in the evening than that of *M. melolontha* [*cf.* **29** 488], and the adults flew to the nearest trees to feed and oviposited close to them, whereas swarms of *M. melolontha* always flew along definite routes to feeding grounds that were sometimes over two miles away, passing fruit trees on the way, and made return flights in the opposite direction for oviposition. In the case of the latter species, therefore, it is far more important to know the usual flight routes and preferred feeding sites than the actual places of the emergence if the beetles are to be destroyed by mass collection.

In **Ueber die Bekämpfung des Maikäfer-Engerlings mit Bodenvergasungsmitteln** [Control of the Cockchafer Larva with Soil Fumigants], pp. 2253–2257, 3 refs., W. Thalenhorst emphasises the value of soil fumigation against larvae of *Melolontha* under forest conditions where deep ploughing is impossible. Recent laboratory and field experiments showed that allyl isothiocyanate (mustard oil) and chlorpicrin were the most effective fumigants [**25** 308], and the former is recommended, as it costs only half as much as the latter. It has been found, however, that it is inadvisable to apply it in the form of an emulsion in water [*cf. loc. cit.*], as it tends to decompose and become ineffective in damp soil, and that its rate of spread is reduced in clay soils with fine particles. Its practical use should therefore be preceded by tests of its effectiveness in soils of different types.

Schaerffenberg (B.). **Zur Unterscheidung der Larven von** *Agriotes obscurus* **L. und** *Agriotes lineatus* **L.** [Distinguishing the Larvae of *A. obscurus* and *A. lineatus*.]—*Z. PflKrankh.* **53** no. 8–12 pp. 283–285, 7 refs. Stuttgart, 1943.

The author states that his observations in Germany have confirmed the finding of Subklew [*R.A.E.*, A **22** 466] that larvae of *Agriotes obscurus*, L., and

A. lineatus, L., can usually be distinguished from each other by the mandibles, but that this method is not always reliable. He therefore investigated larvae of both species from the district of Rostock and found that they could also be distinguished by characters of the ninth abdominal segment and by coloration. The differences are described, and a key to the two species, based on them, is given.

KORSCHEFSKY (R.). **Bestimmungstabelle des bekanntesten deutschen Elateridenlarven.** [A Key to the best-known German Elaterid Larvae.]—*Arb. morph. taxon. Ent. Berl.* **8** pp. 217–230, 3 pls., 4 figs. 1941. (Abstr. in *Z. PflKrankh.* **53** no. 8–12 p. 306. Stuttgart, 1943.)

This is the third part of a series of keys to the larvae of German Coleoptera and includes 45 species of Elaterids, with notes on their habits.

KADOCSA (G.). **Adatok a gabonafutrinka alaktan ának, életmód/jának és kártételének ismeretéhez.** [Contributions to the Knowledge of the Morphology, Life-history and Injuriousness of *Zabrus tenebrioides*.]—*Különlenyomat a Növényegészégügyi Évkönyv I. (1937–40) kötetéből* pp. 38–82, 6 pls. Budapest, 1941. (Abstr. in *Z. PflKrankh.* **53** no. 8–12 pp. 305–306. Stuttgart, 1943.)

Zabrus tenebrioides, Goeze, is common on the plains of Hungary. The adults attack the seeds of barley, wheat, oats and wild grasses and also feed occasionally on animal matter, including their own eggs. They do not aestivate and continue to feed during the day. The females deposit 80–100 eggs, and those that have not completed oviposition during the autumn hibernate. The eggs hatch in 2–3 weeks, but those deposited late overwinter. The larvae attack winter wheat and also rye, barley, oats and maize. They pupate in May at depths of 4–6 ins., and the pupal stage lasts 3–4 weeks.

From data for the years 1883–1933, the author concludes that damage is serious only in seasons preceded by long mild autumns, which favour oviposition. It is increased if winter cereals follow a cereal crop or are sown next to it. Rotation of crops and intensive cultivation of the soil are therefore recommended for control.

TIEL (D.). **A *Dreyfusia nüsslini* elofordulása hazánkbán.**—*Erdész. Lap.* **80** pp. 351–358. Budapest, 1941. (Abstr. in *Z. PflKrankh.* **53** no. 8–12 p. 311. Stuttgart, 1943.)

Chermes nordmannianae, Eckstein (*Dreyfusia nüsslini*, Börner) has caused such severe injury to both old and young firs [*Abies*] near Kassa, in Hungary, that many trees have had to be felled prematurely. Hard winters and cool damp summers are unfavourable to this Aphid.

LOVÁSZY (P.). **Zur Kenntnis der Schlupfwespen einiger schädlichen Rindenkäfer.** [A Contribution to the Knowledge of the Hymenopterous Parasites of certain injurious Bark-beetles.]—*Ann. ent. fenn.* **7** no. 3–4 pp. 194–204. 1941. (Abstr. in *Z. PflKrankh.* **53** no. 8–12 p. 306. Stuttgart, 1943.)

War conditions have led to the accumulation of much dead and dying timber in eastern Finland, which may encourage outbreaks of bark-beetles. The author therefore investigated the extent to which these and other bark insects are parasitised in pine and spruce. The parasites bred comprised *Ephialtes* (*Pimpla*) *terebrans*, Ratz., from *Pissodes validirostris*, Sahlb.; *Coeloides abdominalis*, Zett., from *Myelophilus* (*Blastophagus*) *piniperda*, L., *Pissodes pini*, L.

P. harcyniae, Hbst., and *Ips proximus*, Eichh.; *C. melanotus*, Wesm., and *C. bostrychorum*, Giraud, from *P. pini*; *Allodorus semirugosus*, Nees, from *P. harcyniae*; *Eurytoma rufipes*, Wlk., from *M. piniperda* and *Hylastes* (*Hylurgops*) *palliatus*, Gylh.; *E. curculionum*, Mayr, from *P. validirostris*; *E. ischioxanthus*, Ratz., from *Ips* (*Pityogenes*) *chalcographus*, L., *I.* (*P.*) *bidentatus*, Hbst., and *I.* (*P.*) *quadridens*, Htg.; *E. nobbei*, Mayr, from *Magdalis violacea*, L.; *Rhopalicus suspensus*, Ratz., from *P. harcyniae*, *Myelophilus piniperda* and *I. typographus*, L.; *R.* (*Pteromalus*) *azureus*, Ratz., from *I. proximus*, *I.* (*Pityogenes*) *bidentatus*, and *H. palliatus*; and *Rhoptrocerus* (*Pachyceras*) *xylophagorum*, Ratz., from *I. chalcographus*, *I. bidentatus* and *H. palliatus*.

Lovászy (P.). **Ueber das schädliche Auftreten von** *Laspeyresia illutana* **H. S. (Lep., Tortricidae).** [The Occurrence as a Pest of *Cydia illutana*.]—*Ann. ent. fenn.* **8** pp. 214–217. 1942. (Abstr. in *Z. PflKrankh.* **53** no. 8–12 p. 309. Stuttgart, 1943.)

Cydia (*Laspeyresia*) *illutana*, H.-S., is here recorded, for the first time in Finland, as a pest in the cones of Norway spruce, *Picea abies* (*excelsa*). The eggs are laid in fresh cones of spruce or larch (*Larix sibirica*) in the second half of July, and the larvae hatch from the end of July. They become full-fed at about the end of August, leave the cones and overwinter in the soil. There is only one generation a year. Infested cones do not open properly and retain some of their seeds. Damage to spruce cones was fairly heavy in northern Finland in 1940 and 1941, but was of much less economic importance than that caused by *C.* (*L.*) *strobilella*, L., and *Dioryctria abietella*, Schiff.

Bovien (P.) & Stapel (C.). **Paeregalmyggens Biologi og Bekaempelse.** [The Biology and Control of the Pear Gall-midge.]—*Tidsskr. Planteavl* **47** pp. 600–625. 1943. (Abstr. in *Z. PflKrankh.* **53** no. 8–12 p. 307. Stuttgart, 1943.)

In the course of ten years' work in Denmark, the best control of *Contarinia pyrivora*, Ril., on pear, was given by spraying the trees and surrounding soil with nicotine two or three times during the emergence period of the adults [*cf. R.A.E.*, A **25** 766]. Practically equal control was obtained by treating the soil with 5 per cent. tar distillate at the rate of 3–4½ pints per sq. yd. shortly before the adults emerged in spring and just before the larvae entered the soil in summer. Calcium cyanamide was effective only at rates that injured the trees.

Neergaard (P.). **Verslag over de Werkzaamheden van den Plantenziektenkundigen Dienst in het Jaar 1941.** [Report of the Service of Plant Pathology for the Year 1941.]—*Versl. PlZkt. Dienst Wageningen* no. 100, 77 pp., 5 pls. Wageningen, 1942. (Abstr. in *Z. PflKrankh.* **53** no. 8–12 pp. 313–314. Stuttgart, 1943.)

Insect pests of crops in Holland in 1941 included *Thrips angusticeps*, Uzel, *Hylemyia* (*Chortophila*) *cilicrura*, Rond., and *Halticus saltator*, Geoffr., on beans, *Cnephasia wahlbohmiana*, L., on flax and peas, *Ceuthorrhynchus rapae*, Gylh., on cabbage, *Trogophloeus elongatulus*, Erichson, on cucumber, *Xyleborus* (*Anisandrus*) *dispar*, F., on fruit trees injured by frost, *Euxoa* (*Agrotis*) *nigricans*, L., which fed on the young shoots and blossoms of grape vine, and *Tortrix* (*Cacoecia*) *rosana*, L., on peach and blueberry (*Vaccinium corymbosum*). Injury to beans by *Tarsonemus pallidus*, Banks, increased in West Friesland. This mite overwinters on the poles used for the beans and can be controlled by immersing the poles in water for a fortnight in May.

Springensguth (W.). *Dilophonota* (*Erinnyis*) *ello* **L. als Schädling an** *Manihot utilissima* **Pohl.** [*Erinnyis ello* as a Pest of *M. utilissima*.]—*Anz. Schädlingsk.* **17** pp. 64–67. 1941. (Abstr. in *Z. PflKrankh.* **53** no. 8–12 p. 307. Stuttgart, 1943.)

The extensive cultivation of cassava (*Manihot utilissima*) in southern Brazil has led to a great increase in diseases and pests of this plant, including the Sphingid, *Erinnyis* (*Dilophonota*) *ello*, L., which completely defoliates the crop every 7–10 years [*cf. R.A.E.*, A **31** 414]. In cage studies of its bionomics, the adults survived for an average of 25 days, and the females laid 40–75 eggs. The five larval instars were completed in 16–20 days, and the pupal stage lasted 19–21 days. There were two generations a year.

Schwerdtfeger (F.). **Ueber Herdtheorie und Massenwechsel der Insekten.** [The Focus Theory and Changes in Insect Populations.]—*Anz. Schädlingsk.* **18** pp. 121–124. 1942. (Abstr. in *Z. PflKrankh.* **53** no. 8–12 p. 311. Stuttgart, 1943.)

The author criticises the false use with reference to insect outbreaks of the "focus theory," according to which such outbreaks begin in a more or less restricted area and then spread by migration, either active or passive, continuous or discontinuous, over considerable distances. The theory usually accepted is that of the "autochthonous origin" of outbreaks, which are the result of excessive reproduction of the insects already present in a district. Unequal development and seasonal distribution of damage through a forest give a false appearance of distinct foci.

The physiological condition of the insects is more or less independent of many environmental factors, such as exceptional weather conditions, parasites or predators, but is closely related to others, such as regular temperature, humidity, diseases and availability of food, but investigations of individual factors cannot provide a satisfactory solution to the general problem of the causation of outbreaks.

Jancke (O.). **Ungewöhnliche Frasspflanzen der Traubenwickler.** [Unusual Food-plants of *Clysiana ambiguella*.]—*Dtsch. Weinb.* **20** pp. 669–670. 1941. (Abstr. in *Z. PflKrankh.* **53** no. 8–12 p. 308. Stuttgart, 1943.)

Symphoricarpus racemosus is known to be one of the food-plants of *Clysiana* (*Conchylis*) *ambiguella*, Hb., and was found to be heavily infested by the Tortricid in a district in the Rhineland in the autumn of 1941. It is therefore recommended that this and other ornamental and hedge shrubs on which the moth can breed should not be planted near vineyards.

Stellwaag (F.). **Neue Forschungen über Mottenflug, Eiablage und Eidauer der Traubenwickler.** [Recent Investigations on Moth Flight, Oviposition and the Development of the Eggs of the Vine Moths.]—*Dtsch. Weinb.* **22** pp. 203–206. 1943. (Abstr. in *Z. PflKrankh.* **53** no. 8–12 p. 308. Stuttgart, 1943.)

From consideration of earlier and more recent observations in the Rhineland, the author concludes that the peaks of oviposition of the vine moths [*Clysiana ambiguella*, Hb., and *Polychrosis botrana*, Schiff.] coincide with the peaks of moth flight, so that the use of trap-glasses is justified. The composition, activity and fecundity of the moth population cannot be satisfactorily estimated from the results of jarring. Egg counts are not satisfactory as a basis for general forecasts, though they can be used in cool weather to supplement the results of the trap-glasses.

It is emphasised that the rate of egg development depends on microclimate and not the climate of the region, and that development is quicker at changing than at constant temperatures. Thus, the egg stage lasts 15½ and 8 days at constant temperatures of 15 and 20°C. [59 and 68°F.], respectively, and 12 and about 7 days, respectively, at field temperatures averaging these figures.

Götz (B.). **Nachträgliche Mitteilungen zur Frage der Verwendung von Fangbändern gegen die Traubenwickler.** [Supplementary Contributions to the Problem of using Trap Bands against the Vine Moths.]—*Wein u. Rebe* **24** pp. 177–184. 1942. (Abstr. in *Z. PflKrankh.* **53** no. 8–12 p. 309. Stuttgart, 1943.

Observations in various vineyards in Germany showed that few pupae of *Polychrosis botrana*, Schiff., and very few of *Clysiana ambiguella*, Hb., were taken in corrugated paper bands [*cf. R.A.E.*, A **27** 458], though infestation was heavy, and fewer occurred in bands placed on the vines than in those on the posts. The numbers were not much increased by colouring the bands and only slightly so by using bands with wadded inner surfaces.

Wolff-Schötmar (G.). **Larve der Stachelbeerblattwespe als Nahrung der Dorngrasmücke** (*Sylvia c. communis* **Latham**). [Larvae of the Gooseberry Sawfly as Food for *Sylvia communis*.]—*Dtsch. Vogelwelt* 1941 pp. 59–60. (Abstr. in *Z. PflKrankh.* **53** no. 8–12 p. 309. Stuttgart, 1943.)

Although experiments have shown that sawfly larvae are not eaten by insectivorous birds, *Sylvia communis* was found taking larvae of *Nematus* (*Pteronus*) *ribesii*, Scop., from the leaves of gooseberry in Germany and also from the soil beneath the bushes.

Ass (M. J.) & Funtikow (G. P.). **Die Besiedlung künstlich geschwächter Bäume durch schädliche Insekten.** [The Infestation of artificially weakened Trees by harmful Insects.]—*Z. angew. Ent.* **28** pp. 157–179. 1941. (Abstr. in *Z. PflKrankh.* **53** no. 8–12 p. 310. Stuttgart, 1943.)

This is an account of observations in Germany on the insect population that developed in a spruce and a pine tree that were injured by fire in 1928 and in another spruce tree that had its crown sawn off in the same year. Pests, chiefly bark-beetles, attacked the trees in large numbers, so that the scorched trees were completely dried out by 1930. *Ips typographus*, L., attacked both the spruces equally, but *I. chalcographus*, L., preferred the one that had been sawn off.

Schwerdtfeger (F.). **Zur Biologie des Forstschädlings** *Acantholyda erythrocephala* **L.** [On the Biology of the Forest Pest, *A. erythrocephala*.]—*Photogr. u. Forsch.* **3** pp. 161–169. 1941. (Abstr. in *Z. PflKrankh.* **53** no. 8–12 pp. 310–311. Stuttgart, 1943.)

Areas in Germany that were reforested with pine after the outbreak of *Panolis flammea*, Schiff., in 1922–24 appear to be offering favourable conditions for certain sawflies, including *Diprion pini*, L., that do not usually reach outbreak numbers. *Acantholyda erythrocephala*, L., has recently caused considerable damage to stands 9–12 years old. In March 1940, old needles were lacking and even some of the young ones had been attacked. The May shoots showed injury to the bark and needles and were backward in growth. The larvae overwinter, some of them more than once. Pupation occurs in spring, and the pupal stage lasts 1–3 weeks. The eggs are laid in the needles, and the larvae feed in groups of up to 35 in webs. They first attack the old shoots, and then, for lack of food, the May shoots. They can be controlled by dusting with an arsenical from an aeroplane [*cf. R.A.E.*, A **30** 540].

Steudel (W.). **Die Beziehungen zwischen Puppengrösse und Eizahl bei der Nonne** (*Lymantria monacha* **L.).** [The Relations between Size of Pupae and Number of Eggs in *L. monacha*.]—*Mitt. Forstwirt. Forstwiss.* **12** pp. 83–90. 1941. (Abstr. in *Z. PflKrankh.* **53** no. 8-12 p. 312. Stuttgart, 1943.)

The number of viable eggs produced by *Lymantria monacha*, L., increases with the diameter of the pupae from which the females develop. The increase is proportionately greater with the greater diameters, and the relation can be represented by an exponential curve. The diameter of viable female pupae ranges from 4·7 to 8·9 mm. and the number of eggs from 0 to 443. The variation in the numbers of eggs is comparatively great in each diameter class and also increases with the diameter of the pupae. The maximum number of eggs that can be produced is estimated at 500. Pupae of equal size reared under dissimilar conditions give rise to almost equal numbers of eggs suitable for deposition, but the numbers of those that are fertilised vary.

Schütz (K.). **Das Schaumnebel-Spritzverfahren.** [The Foam-mist Spraying Process.]—*Mitt. Landw.* **58** pp. 551–552. 1943. **Spritzung mit Schaumnebel.** [Spraying with Foam-mist.]—*Techn. Landw.* **24** pp. 35–40. 1943. (Abstr. in *Z. PflKrankh.* **53** no. 8–12 pp. 314–315. Stuttgart, 1943.)

In these two papers, of which the second contains more technical detail, the author describes a process for effecting economy in spraying by introducing a foaming agent into the spray stream on its way to the nozzle, in which the size of aperture is increased. The result is a fine mist ; less pressure and only one-fourth as much water is required as for an ordinary spray, and the amount of poison to be applied against *Leptinotarsa decemlineata*, Say, on potato can also be reduced by 75 per cent.

Dierick (G. F. E. M.). **De ovicide werking van wintersproeimiddeln.** [The ovicidal Effect of Winter Sprays.]—Dissert. Univ. Amsterdam, 117 pp. Assen, Van Gorkum & Co., 1942. (Abstr. in *Z. PflKrankh.* **53** no. 8–12 p. 316. Stuttgart, 1943.)

Eggs of *Ephestia kuehniella*, Zell., were found to be as suitable as those of *Aphis* (*Doralis*) *pomi*, Deg., for testing winter ovicides, and they have the advantage of being obtainable throughout the year. The eggs are lightly scattered over the solution to be tested, recovered on filter paper and kept in open petri dishes at 20°C. [68°F.] for 7-8 days, the normal duration of the incubation period. The results with eggs attached to twigs were also similar to those obtained with Aphid eggs.

Investigations on the causes of the divergent effects of various preparations of dinitro-ortho-cresol showed that solutions in which the cresol was present as the acid were more effective than those in which it occurred as a salt. Toxicity was found to depend on the concentration of undissociated molecules of the acid ; the molecules of salts were not toxic, and the apparent toxicity of solutions of the salts is probably due to the presence of undissociated acid molecules. In comparative tests the ammonium salts were more effective than those of potassium, sodium or lithium. When combined with mineral oils, there was an increase in toxicity in acid emulsions and a decrease in alkaline ones. Mineral oils were more effective against eggs 0–1 day old than against those 5–6 days old. At very low concentrations, dinitro-o-cresol was found to stimulate egg development.

Gösswald (K.). **Die rote Waldameise und ihre Umwelt.** [The Red Forest Ant and its Environment.]—*Biologe* **11** pp. 180–191. 1942. (Abstr. in *Z. PflKrankh.* **53** no. 8–12 p. 317. Stuttgart, 1943.)

The author considers that the red forest ant [*Formica rufa*, L.] is an important factor in the prevention of outbreaks of forest insects in Germany [*cf.* *R.A.E.*,

A **31** 76, 123]. It is itself independent of insect pests, since it also fosters harmless bark Aphids, it regulates its own climate in its nests, and is an efficient hunter, attacking its prey in various stages.

Gösswald (K.). **Künstliche Vermehrung der roten Waldameise.** [Artificial Multiplication of the Red Forest Ant.]—*Mitt. biol. Reichsanst.* no. 63 pp. 44–46. 1941. (Abstr. in *Z. PflKrankh.* **53** no. 8–12 p. 320. Stuttgart, 1943.)

Attempts to breed *Formica rufa*, L., must be based on knowledge of its races, which differ in their ecology. The number of true queens per nest ranges from 1 in the case of *F. r. rufa* to up to 60 for the large form of *F. r. rufo-pratensis*, Forel, and 200–5,000 for the small form of the latter. These forms react differently to weather and differ in the number of nests per colony. Breeding in the open is carried out in spring by means of chambers containing at least 50,000 workers, to which 1–2, up to 50 or 500 queens, respectively, are added [*cf. R.A.E.*, A **31** 451]. A case is cited in which the population of *Diprion pini*, L., was practically eliminated in the area within reach of ants bred in this way [*cf.* **31** 76].

Röszler (P.). **Diebsameisen zur Bekämpfung schädlicher Ameisen.** [Robber Ants for the Control of harmful Ants.]—*Umschau* **46** no. 24–25. 1942. (Abstr. in *Z. PflKrankh.* **53** no. 8–12 p. 318. Stuttgart, 1943.)

From experiments with *Solenopsis fugax*, Latr., which lives in or near the nests of other, mostly larger, ants and feeds on their brood, the author concludes that this species could be used to control harmful ants, such as *Lasius niger*, L.

In a note to the German abstract, however, K. Gösswald points out that in temperate regions, such as Germany, *S. fugax* can live only in specially warm surroundings, so that it could not be of any general use. Furthermore, there is risk that it might itself develop into a household pest, especially in centrally heated premises, as *S. geminata*, F., has done.

Pavlakos (J. G.). **Zur Biologie und Bekämpfung des orangeroten Melonenkäfers *Aulacophora abdominalis* Gerst. (Col. Chrysomel.) in Griechenland.** [The Biology and Control of *Aulacophora foveicollis*, Luc. in Greece.]—*Z. angew. Ent.* **30** pt. 1 pp. 1–78, 32 figs., 31 refs. Berlin, 1943.

Aulacophora foveicollis, Lucas (*abdominalis*, auct.), all stages of which are described in detail, is widely distributed on sweet melons in Greece and is a serious pest in some areas, where it may destroy whole plantations. The adults feed on the leaves of young plants, causing death or retardation of growth, and the larvae attack the roots and stems below the ground when the plants are mature and fruiting, as a result of which the roots and stems rot and are invaded by fungi, the plants wither, and half-ripe fruits dry in the sun. An account is given of the culture of melons in Greece, where they are also attacked by *Agrotis segetum*, Schiff., *Aphis papaveris*, F., *Epilachna chrysomelina*, F., and three species of fungi, and the distribution and food-plants of the species of *Aulacophora* are reviewed. *A. foveicollis* is the only one present in Greece, and has been known there since 1908, having probably spread or been introduced from Turkey.

Investigations on the bionomics of this Galerucid were carried out in 1937–39. It overwintered in the adult stage and appeared to have only one generation a year. In the laboratory, the eggs were kept on very moist filter paper, the larvae were given pieces of melon fruit, into which they burrowed after feeding superficially for the first 2–3 days, and were provided with earth in which to pupate, and the adults were given melon leaves. The adults refused to feed on wild plants from the vicinity, though they are known to do so before the melon

plants appear ; water-cucumber (*Lagernaria vulgaris*) and water-melon (*Citrullus vulgaris*) were not attacked, but the beetles readily fed on the fruit of many kinds of plants and on sugar solution, and have been observed in the field feeding on fruits that have fallen because of infestation by other insects and on the nectar of flowers. In the field the eggs were laid on the damp earth round plants, mainly in shady places or under clods and usually singly or in pairs, whereas in the laboratory they were deposited in masses, chiefly on the damp stems of melon leaves introduced for food, probably because the surroundings were too dry. Oviposition was greatest from the beginning of June to the middle of July. The total and daily numbers of eggs per female were 19–697 and 0·7–8·7 in the laboratory, but numbers may be larger in the field ; the oviposition period was 8–111 days. Eggs were usually killed when exposed to alternate drought and moisture, but gave rise to normal larvae when immersed in water. Larvae were present in the field from June to early September and fed only on *Cucumis melo* and a closely allied species also cultivated in Greece ; they preferred the roots, but fed on the upper parts of the plants, including leaves and fruits in contact with the soil, when the roots were waterlogged. They pupated in the soil at a depth of 2–5 ins. and a distance of 2–12 ins. from the roots. The egg, larval and pupal stages lasted 9–14, about 29 and 15–18 days, respectively. The new adults began to emerge in the middle of July ; they flew for great distances in all directions and fed on cucurbits, tomato, maize and lucerne until the end of November, when they went into hibernation on the ground under dry, half rotted weeds and plant remains. Hibernation was sometimes interrupted on warm days. They reappeared during the first sunny days of March, sheltering in thick vegetation until the weather was settled and the melon plants were sufficiently advanced to give protection. They were most numerous in the middle of June, and were in flight and fed on the melon leaves in the temperate hours of the day, chiefly in the morning, sheltering under leaves or débris at noon and during the night. The optimum temperature appeared to be 23–26°C. [73·4–78·8°F.]. Mating began in early May, 8–10 days after the adults first appeared on the melon plants, reached a maximum in late May and continued until the end of August. The populations remained fairly constant, in spite of extremes of climate, and probably depend mainly on the type of soil, provided that adequate shelter is present.

Hypopi of a Tyroglyphid of the genus *Histiostoma* attacked and killed larvae of *A. foveicollis*, but did not appear to give much control. Dusting the plants with ash, chalk, road-dust or the dusts used against fungi repelled the beetles temporarily, and arsenical sprays and dusts were no more effective, but better results were obtained with sprays containing 2·5 per cent. sodium or barium fluosilicate and 6 per cent. sugar ; these did not damage the plants. The sprays should be applied two or three times at intervals of six days when the adults first appear on melon, with an additional application if necessary. Proprietary sprays containing nicotine were ineffective. Handpicking in the cool hours of the morning gives some control. In tests in which 50 gm. was poured into a hollow between each plant and the surrounding earth, 15 per cent. cresol and a proprietary solution both gave 92·5 per cent. mortality of the larvae and also killed the eggs. The treatment should be applied as soon as damage is observed (when two or three plants begin to shrivel), and repeated two or three times at intervals of five or six days. Soil fumigation with paradichlorbenzene or carbon bisulphide damaged the plants and was effective only in fields that were not often irrigated. Cultural methods of control include heaping earth round the base of the plants before oviposition occurs, and removing it later with the eggs it contains ; manuring to stimulate new growth in infested roots ; keeping irrigation channels 6–8 ins. from the plants, so that the eggs near the plant stem are too dry to develop ; and spreading dry material on the ground beneath the plants, so that fruits do not touch the damp ground and become mined by the larvae.

GYÖRFI (J.). **Beiträge zur Kenntnis der Wirte von Schlupfwespen.** [Contributions to the Knowledge of Hosts of Hymenopterous Parasites.]—*Z. angew. Ent.* **30** pt. 1 pp. 79–103. Berlin, 1943.

The author discusses the control of injurious insects by means of Hymenopterous parasites and gives the results of breeding experiments carried out in Hungary over a number of years to discover parasites of forest and agricultural pests ; less important insects, which might serve as alternative hosts, were also investigated. New or first host records were obtained for some of the parasites. Lists are given of the host insects dealt with, with the parasites reared from them, and of the parasites, with the hosts from which they were reared. The place and time at which the hosts were collected, their food-plants and, in the case of secondary pests, the primary cause of injury are included.

BECKER (G.). **Zur Oekologie und Physiologie holzzerstörender Käfer.** [The Ecology and Physiology of Beetles destroying Wood.]—*Z. angew. Ent.* **30** pt. 1 pp. 104–118, 8 figs., 40 refs. Berlin, 1943.

The author summarises the results of investigations carried out for 6–7 years on the ecology and physiology of *Hylotrupes bajulus*, L. [*cf. R.A.E.*, A **31** 121], *Anobium punctatum*, Deg. [*cf.* **29** 233] and *Ergates faber*, L. [*cf.* **30** 614], which are the only insects, except species of *Lyctus*, that cause extensive damage to timber in buildings in Germany. Temperature and humidity affect the adults and eggs more than the larvae within the wood, as this is a bad conductor of heat and does not vary much in water content. The optimum temperatures for larval development are 22–23°C. [71·6–73·4°F.] for *A. punctatum* 28–29°C. [82·4–84·2°F.] for *H. bajulus*, and 30–31°C. [86–87·8°F.] for *E. faber*, and the respective upper limits are 28°C., 37°C. [98·6°F.] and even higher ; adults and eggs of *Hylotrupes* and *Ergates* are also favoured by a higher temperature than those of *Anobium*. Larvae of *Anobium* develop most readily at a relative humidity of 55–65 per cent., though development continues at only 40 per cent. in some stages. Those of *Hylotrupes* develop most readily at 45–50 per cent. and die in really wet wood, and those of *Ergates* require at least 90–95 per cent. and can endure 100 per cent. for a long time ; the eggs of *Ergates* develop at about 80 per cent. relative humidity. Other insects that damage wood and have about the same lower limit of humidity as *Ergates* include *Leptura rubra*, L., and *Spondylis buprestoides*, L.; *Coelostethus* (*Dendrobium*) *pertinax*, L., *Xestobium rufovillosum*, Deg., *Codiosoma* (*Pselactis*) *spadix*, Hbst., *Rhyncolus culinaris*, Germ., and *Eremotes elongatus*, Gylh., which are less important, develop in moister conditions than *Anobium* or *Hylotrupes*. All these species are controlled to some extent by the drying processes to which the timber is subjected for protection against fungi. Both *Anobium* and *Hylotrupes* are most injurious in coastal districts, and precautions should be taken against infestation where the relative humidity is 50 per cent.

The larvae of *H. bajulus*, *Ergates faber* and *A. punctatum* can break down the cellulose in the wood ; the last two and also *L. rubra* can develop for some time on cellulose only, but *H. bajulus* requires some additional unknown substance for growth, though it can survive for a long time without food. An increase in the content of carbohydrates such as glucose hampers the development of *Hylotrupes* and increases the quantity of wood destroyed, but the addition of simple carbohydrates may be favourable for *Anobium* and *Ergates*. Although parts of other carbohydrates can be broken down and even assimilated, the amount of these substances in the cells does not affect the suitability of the wood as food. The removal of oils, fats and resin from wood improves its value as food to a small extent in the case of *Anobium* and *Ergates* and considerably for *Hylotrupes*. The larval growth of *Hylotrupes* ceases for a slight addition of these substances and accelerates as the amounts present decrease. Albumin,

which is present in dead wood in very small quantities, is necessary to the larvae of this species, and increased amounts of it very greatly accelerate their development and reduce the amount of wood they destroy in completing a given amount of growth. Extensive reduction of the albumin content of wood causes the death of the larvae, and the author considers that further study of the nutrition of this species, which is less vulnerable to climate than any other insect attacking wood, might indicate possible methods of control. The development of *E. faber*, *A. punctatum* and *L. rubra*, which possess symbiotic yeasts in the gut, is comparatively little accelerated by the addition of albumin.

Natural enemies give little control of *Hylotrupes*; the predacious Clerid, *Opilo domesticus*, Sturm, limits its development to some extent, but seldom has any lasting effect. *Ergates* is attacked more by vertebrate animals and the fungi present in damp surroundings than by insects, and *Anobium* is attacked by *O. domesticus*, *Pediculoides ventricosus*, Newp., and the Braconid parasite, *Spathius exarator*, L.

Hylotrupes larvae mature only in coniferous timber, dying sooner or later when fed on deciduous wood, and experiments show that the choice of sites for oviposition is affected by smell, the gravid females being attracted by the odour of conifer wood, as well as by temperature and light. The probability of infestation by *Hylotrupes* in buildings therefore depends on the albumin content and on the amount of attraction from resins present in the wood. It is, however, notable that the females prefer to oviposit in wood that, owing to its content of essential oils, permits only limited development of the larvae, and the discovery of attractive factors, which appear to be the same for *E. faber*, but different for certain other pests of wood, might afford a practical method of control by means of baits.

Sylvén (E.). **Die Biologie des Buchenspinners** *Dasychira pudibunda* **L.** [The Biology of *Dasychira pudibunda*, L.]—*Z. angew. Ent.* **30** pt. 1 pp. 119–142, 16 figs., 15 refs. Berlin, 1943.

Dasychira pudibunda, L., all stages of which are described in detail, was very numerous during 1941–42 in forests in the Schonen province of Sweden, particularly on beech. In the laboratory, males and females lived for averages of 11 and 7 days, respectively. Newly emerged females contained 20–400 eggs, not all fully developed. Pairing occurred immediately after emergence, and oviposition followed at once. The eggs were normally laid in masses on beech, oak, spruce, including the needles, and weeds, and were deposited on almost every part of trees of all ages, but chiefly in sheltered positions on leaves and thin twigs in the lower two-thirds of the crown. Egg masses contained an average of 115 eggs, and the numbers per tree were estimated at about 10,000 in 1942. The eggs were resistant to changes in temperature and hatched in about three weeks. Larvae appeared throughout June in 1942; the young larvae were very active and spun threads by which they were blown from tree to tree, so that the amount of oviposition on a tree did not determine the degree of damage to it. Older larvae crawled from tree to tree. They are positively phototropic, but survived for a month in the dark in the laboratory. The larvae fed on almost any vegetation including several kinds of deciduous trees, consuming quite tough leaves; the five larval instars occupied about a month and a half, and defoliation occurred towards the end of August and in September. Mature beeches suffered first, the infestation then spread to the surrounding vegetation, and later the ground was strewn with the bodies of starved larvae. Pupation began at the end of September, and cocoons were often spun between two fallen beech leaves or under stacks of logs. The pupae were resistant to changes of temperature, and normally overwintered under snow; damp weather may be less favourable, though one pupa transformed after complete immersion for 59 hours in the laboratory.

Birds ate the pupae in winter if they were not covered by snow, but did not attack the larvae. No eggs were found to be parasitised. The Ichneumonids, *Automalus alboguttatus*, Grav., *Pimpla* (*Coccygomimus*) *instigator*, F., and *Ephialtes* (*Epiurus*) *inquisitor*, Scop., of which the first two were the most important, were found parasitising the larvae and pupae to some extent. *P. instigator* and *E. inquisitor* emerged at the same time as *D. pudibunda*, and *A. alboguttatus* some 14 days later. Several larvae of *E. inquisitor* occurred in one host ; they left it when it began to spin its cocoon and made parchment-like cocoons within the latter. The other two parasites overwintered as larvae in the pupae of the host ; pupae parasitised by *P. instigator* were recognisable by their paralysed abdominal parts and light weight. Only 2–3 per cent. of the pupae examined in 1941–42 were parasitised by Diptera, of which *Carcelia gnava*, Mg., was the most important. *Dasychira* cocoons were found to contain 1–3 pupae of this Tachinid. The most important parasite of *D. pudibunda* was the fungus, *Cordyceps militaris*, which attacked larvae and pupae and was found infesting 15 per cent. of the pupae over a sample area of 1 sq. metre [*cf. R.A.E.*, A **31** 369]. The larvae were also attacked by bacteria.

Even in heavy infestations, defoliation did not occur until the end of the season, and the beech nuts were therefore normal, though they were lighter than usual, but defoliation affected the development of young shoots and the flow of sap, resulting in pale-coloured leaves and tough wood, which made the trees difficult to fell, in the following year ; it is possible that young trees may succumb to repeated attacks.

KRISHNA AYYAR (P. N.). **Further Studies on the Distribution and seasonal History of Cotton Stem Weevil**—*Pempherulus affinis* (**Fst.**)—**in South India.**—*Indian J. agric. Sci.* **13** pt. 3 pp. 255–263, 15 refs. Delhi, 1943.

The investigations carried out in India in 1935–38 on the distribution, incidence and natural enemies of *Pempherulus affinis*, Faust, on cotton and other food-plants [*R.A.E.*, A **32** 391], were supplemented by another year's work on certain aspects of the problem, the results of which are given in this paper, which includes a record of the presence of the weevil in large numbers in Siam. Surveys in four ecologically distinct tracts in the southern half of Madras, which are discussed with reference to ecological and climatic conditions and to the occurrence in them of food-plants of *P. affinis*, showed that it is present in all of them on food-plants other than cotton, which is not cultivated in two tracts and is of importance only in parts of one. In this last region, infestation on cotton is light in many places, and serious in others, especially on a perennial variety of cotton. In the district in which cotton is a minor crop, the highest average infestation on it may not reach 1 per cent. The factors affecting the abundance of the weevil are not understood, but its distribution and incidence are closely connected with the presence of the preferred food-plants. On the humid west coast, moisture, which is necessary for the development of the eggs and young larvae, but detrimental to the later immature stages, the adults and oviposition, is probably of importance. In the southern and central districts, where cotton has only recently been introduced as a crop and occurs only in small patches, the weevil has not yet become adapted to it. Furthermore, drought and high temperatures during the summer destroy the wild food-plants, except in favourable situations, thus interrupting facilities for continuous breeding. These observations are supported by the results of laboratory experiments to determine the influence of physical conditions on the weevil [**29** 515]. Observations on its seasonal incidence in two plots of cotton between November 1939 and August 1940 confirmed previous findings [**32** 391], despite marked differences in their rates of infestation. Off-season infestation on country cottons was relatively low during August–October and

reached a minimum in October ; it is not therefore considered to be a serious source of re-infestation for commercial crops.

A list is given of 23 possible alternative food-plants examined during the year, of which 16 were found to be attacked. The average rates of infestation by, and parasitism of, the weevil, were high on *Triumfetta rhomboidea*, and consistently appreciable on *Sida acuta*, *Hibiscus esculentus*, *Corchorus olitorius*, *S. spinosa*, *H. vitifolius*, *S. glutinosa* and *Althaea rosea*. The ability of *P. affinis* to attack a number of food-plants, together with the varying intensities of infestation, indicated the possibility of the occurrence of biological races ; laboratory experiments on the oviposition, longevity, growth and development of individuals from different food-plants showed marked differences in food-plant and habitat preferences among them, although the weevils were morphologically identical.

Parasitism among weevils on cotton was low (0·52-0·83 per cent.) and occurred only in January, February and July. The only parasites obtained were three immature stages of *Euderus pempheriphila*, Ram. Ayyar & Mani, one of *Rhaconotus* sp., and *Spathius critolaus*, Nixon, which was systematically collected and reared on larvae of *Sinoxylon sudanicum*, Lesne, and *Hypolixus truncatulus*, F. ; details of the number of winged and wingless males and females of this parasite reared from each host in each month are given in a table. Parasites were reared from *P. affinis* on *T. rhomboidea*, *Hibiscus vitifolius*, *Sida acuta*, *C. olitorius*, and, for the first time, on *A. rosea* and *Pavonia zeylanica*. In all, 226 examples of at least eight species of insect parasites were obtained from alternative food-plants, including 135 of *Entedon pempheridis*, Ferrière, which was the most numerous and which was absent only during April, 51 of *Dinarmus sauteri*, Masi, which was absent in January–February and rare in March–April, and 19 of *Spathius labdacus*, Nixon, which was absent in April September.

Webster (R. L.) & others. **Entomology.**—*Bull. Wash. agric. Exp. Sta.* no. 435 (53rd Rep. 1942–43) pp. 38–44. Pullman, Wash., 1943.

The numbers of *Crioceris asparagi*, L., on asparagus in eastern Washington were small in 1943 for the second year in succession [*cf. R.A.E.*, A **31** 355], and practically no control measures were necessary. The light infestation is attributed to the normal low winter temperatures and the cool spring and summer. As a result of the appearance of large numbers of *Anasa tristis*, Deg., in eastern Washington since 1937, the cultivation of squash in gardens and the commercial cultivation of a popular, but very susceptible, variety of winter squash over an area of 1,000 acres in the Yakima Valley have practically ceased. Winter-squash plants attacked by this Coreid wither and die; one overwintered adult can cause the death of a seedling in ten days by feeding on it for only one day. Cantaloupe melons in the Yakima Valley may also be attacked, but have been effectively protected by the use of summer squash, which matures early and usually escapes damage, as a trap crop. In varietal trials of field pumpkins, one was found that can survive attack by *Anasa* and provides a fair substitute for the winter squash. Dusts of pyrethrum, activated nicotine and [calcium] cyanide, at rates of 20–40 lb. per acre, gave 90 per cent. control, but at least two applications a week were necessary and the cost is justifiable only on valuable crops ; furthermore, calcium cyanide stunts the plants when applied so frequently. Evidence was obtained in 1943 of an equilibrium between *Anasa* and its new environment, since a fair yield of squash was obtained, even in heavily infested districts and despite the limited control measures available. The smaller numbers of the bug were probably due to the conditions of the season and the reduced acreage under squash in the previous year, but the severity of the injury caused by feeding was also apparently reduced. The Tachinid parasite, *Trichopoda pennipes*, F., was introduced from New Jersey and liberated at three places in the Yakima Valley, where it completed two generations during the summer.

Studies in eastern Washington showed that adults of the western potato flea-beetle [*Epitrix subcrinita*, Lec.] migrate in autumn from the bare potato fields to those that provide vegetative cover, where they overwinter in the soil. On reappearing in March–April, they disperse still further in search of preferred food plants, feeding on any hardy plants that are available. Most adults of the so-called eastern potato flea-beetle [*E. tuberis*, Gentner], however, remain in the potato fields until spring and do not become active until self-set or early potato plants appear. As a plentiful food supply is available throughout the period of emergence, there is little migration, and the numbers of this species tend to increase from year to year, especially in restricted areas where potatoes are planted in the same or in neighbouring fields in successive years. Emergence of flea-beetles was prolonged in 1943, owing to the cool weather, and injury to early and mid-season potatoes was lighter than in 1941 or 1942. In general, 3–5 applications of an insecticide were necessary, and the most successful results were obtained when the first two were separated by an interval of ten days and subsequent ones by intervals determined by the populations observed in individual fields. In field tests of two dusts extensively used by growers, injury to tubers by the larvae was less following the use of one containing 30–40 per cent. cryolite than of one containing 25 per cent. calcium arsenate. Dusts and sprays containing zinc arsenate gave commercial control in tests over a period of three years, and no arsenical injury followed the judicious use of this material. Sprays of Bordeaux mixture with the addition of zinc or calcium arsenate gave reasonable control.

Despite a reduction in 1943 in the acreage of cabbage grown for seed, due to heavy winter mortality, damage to the seed by the cabbage seed-pod weevil, *Ceuthorrhynchus assimilis*, Payk., did not exceed 35 per cent.; parasites considerably reduced the numbers of the weevil before harvest.

In investigations on *Sitona lineatus*, L., in western Washington [*cf.* **31** 356], dusts of cryolite, a mixture of equal parts of natural cryolite and talc, and hydrated lime gave much more promising results in 1943 than in 1942. In addition to its repellent action, the lime exerted an insecticidal action that was not apparent in laboratory tests, and was about equal to that of the mixture; its effect appeared to be one of dehydration, and was probably accentuated by the dry season in 1943. The weevil attacked peas and common vetch [*Vicia sativa*] more readily than purple vetch [*V. atropurpurea*], lucerne and clover, and beans were only slightly damaged. The severe winter weather caused only slight mortality among the hibernating adults, most of which overwinter in hollow stalks near the soil surface. Feeding began in March. The pea moth [*Cydia nigricana*, Steph.] was more injurious to peas and vetch on St. Juan Island than *S. lineatus*, and a pea-moth quarantine restricting the cultivation of these crops was established.

At the rate of 3 lb. per 100 U.S. gals. spray, a low-grade cryolite (72 per cent.) was again found to be as effective as the standard one (90 per cent.) against the codling moth [*Cydia pomonella*, L.] on apple [*cf.* **31** 354]; its use gives the foliage a rusty appearance, similar to that due to a heavy infestation of mites. Satisfactory control of the San José scale [*Quadraspidiotus perniciosus*, Comst.] on apple was given by a dormant spray of oil and lime-sulphur in which the concentration of the oil was only 1 per cent. Surveys to determine the distribution of the pear Psyllid [*Psylla pyricola*, Först.] showed that the pear-growing district of the Yakima Valley was still free from infestation and that no extension of the previously infested area had occurred. Dusting the trees with 4 per cent. nicotine and catching the dead Psyllids on white cloths spread beneath them, and the use of adhesive trap boards disclosed infestations that were not apparent by visual inspection. The shoots springing from the roots of infested trees that have been felled serve as a potential food-supply for the Psyllid; they can be effectively destroyed by means of ammonium sulphamate.

Singleton (H. P.) & others. **Irrigation Branch Experiment Station.**—*Bull. Wash. agric. Exp. Sta.* no. 435 (53rd Rep. 1942–43) pp. 76–85. Pullman, Wash., 1943.

In a section dealing with investigations on the control of *Limonius* (*Pheletes*) *canus*, Lec., and *L.* (*P.*) *californicus*, Mannh., in irrigated land in eastern Washington (pp. 82–83), M. C. Lane and E. W. Jones report that the populations of these wireworms per sq. ft. in plots in which the same crop had been grown for eight years were 7·2 and 0, respectively, in potatoes, 3·6 and 0·4 in wheat, 0·2 and 0·4 in maize, 0 and 1 in lucerne and 0 and 0·2 in sugar-beet. Both species decrease in numbers when lucerne is included in crop rotations, do not increase in maize and sugar-beet, and increase in wheat, while *L. canus* increases in potatoes. In rotations comprising 3–4 years under lucerne followed by 2–3 years under cultivated crops, populations of both species were maintained at a minimum of less than 1 per sq. ft., and the yield of potatoes was higher and the amount of injury lower, particularly when they followed the lucerne, than in shorter rotations. In two-year rotations of potatoes with sugar-beet, wheat or maize or with potatoes, populations and damage to potatoes were higher in manured than in unmanured plots.

The only insecticide to show promise against these wireworms is crude naphthalene, which gives fairly high mortality when incorporated into the soil at rates of 300–500 lb. per acre [*cf. R.A.E.*, A **31** 356]. In gardens it should be used at a rate of 1 lb. per 100 sq. ft. and mixed with the soil as deep as possible immediately before sowing. No injurious effects have been noted on crops planted in treated soil.

Crowley (D. J.). **Cranberry-Blueberry Laboratory.**—*Bull. Wash. agric. Exp. Sta.* no. 435 (53rd Rep. 1942–43) pp. 88–89. Pullman, Wash., 1943.

In work on the control of fireworm [*Rhopobota naevana*, Hb.] on cranberry in Washington in 1943, a commercial nicotine-bentonite (Black Leaf 155) was found to provide a satisfactory substitute for rotenone and pyrethrum when used with light summer oil at concentrations of 6 lb. and 1 U.S. quart, respectively, in 100 U.S. gals. spray. Where the intervals between applications exceed 7–10 days and some of the larvae have become webbed in the tips, the addition of ½ U.S. pint nicotine sulphate per 100 gals. spray is advisable. Cryolite at the rate of 5 lb. cryolite in 100 U.S. gals. water did not prevent the larvae from webbing the tips of the leaves, but controlled them when used at a concentration of 4 lb. per 100 U.S. gals. water with the addition of 1 U.S. quart summer oil; only one or two applications of this spray can be made, however, as it leaves a residue.

Control of the fruitworm [*Mineola vaccinii*, Ril.] was difficult because, owing to cool cloudy weather, the moths emerged at irregular intervals from early June to the second half of August. The nicotine-bentonite spray, however, gave excellent results against it; no oil was included in the sprays applied after 15th August.

Breakey (E. P.) & others. **Western Washington Experiment Station. Entomology.**—*Bull. Wash. agric. Exp. Sta.* no. 435 (53rd Rep. 1942–43) pp. 116–121. Pullman, Wash., 1943.

Some of the information in this report of work in Western Washington in 1942–43 has already been noticed from the main one [*R.A.E.*, A **33** 21]. Losses of sour cherries in the vicinity of Puyallup are due mainly to *Rhagoletis cingulata*, Lw., and *R. fausta*, O.-S., and these fruit-flies are increasing in another district to the north of it that has hitherto been relatively free from infestation. In 1942, cherries treated on 3rd June with a spray containing 3 lb. lead arsenate

and 2 U.S. gals. lime-sulphur in 100 U.S. gals. water and on 17th June and on 2nd July with sprays containing 3 lb. lead arsenate and 1 qt. summer oil emulsion per 100 U.S. gals. were free from infestation, although the cherries in two neighbouring orchards were so heavily infested that they were unmarketable.

Various dusts proved effective against the cabbage seed-pod weevil, *Ceuthorrhynchus assimilis*, Payk., in the laboratory, but field experience has shown that they do not adhere to the cabbage plants under the conditions prevailing at the time when they are applied. Rotenone-bearing dust was the only material that markedly reduced damage in tests in 1942 [*cf.* **31** 355], in which small experimental plots were dusted with a mixture of 20 per cent. ground derris root containing 5 per cent. rotenone, 20 per cent. hard wheat flour, 58 per cent. talc, and 2 per cent. miscible oil as wetting agent and adhesive. The rest of the field was treated with a dust of the same rotenone content based on this formula, and infestation over it averaged 20 per cent., as compared with 35 per cent. in an untreated field less than a quarter of a mile away.

Investigations on infestation of leguminous crops by *Sitona lineatus*, L., in 1942 [**31** 356] are briefly recapitulated. The adults prefer to overwinter in stalks of which the hollows are only slightly larger than their bodies, and several were often found in a single stem. Some feeding probably takes place during warm periods in winter. Several thousand individuals of *Macrocentrus ancylivorus*, Rohw., were obtained from New Jersey and liberated against *Cydia* (*Laspeyresia*) *nigricana*, Steph., on St. Juan Island and at two places on the mainland, but subsequent examination on the former gave no evidence that it had become established.

The value of a number of dust insecticides and repellents in protecting bulbs of *Narcissus* against *Merodon equestris*, F., was tested in 1941–42, the bases of the bulbs being coated with the dusts at planting time. Complete protection was given by a proprietary preparation containing 7·5 per cent. oil in talc, and 1 per cent. malachite green in talc and lead arsenate and talc (1 : 25) were also very effective. The last two, particularly lead arsenate, increased the number of bulbs that developed into plants and the number of flowers produced by them, and the first two caused an increase in the weight of the bulbs produced. Malachite green appeared to have a marked stimulative effect on the growth of the plants, whereas the proprietary preparation produced little effect and lead arsenate reduced the length of the flower stalks. Phenothiazine and cryolite were also tested in talc (1 : 25). The former afforded little protection, but stimulated growth ; the cryolite was markedly toxic to the bulbs and plants, and the bulbs were more heavily infested than the control.

Investigations were also made on the effect on the subsequent growth of bulbs of *Narcissus*, *Iris* and *Lilium* of fumigation with methyl bromide at various dosages against *Rhizoglyphus hyacinthi*, Banks, and *Tarsonemus laticeps*, Halbert. The schedules tested were exposure to 2 or 3 lb. methyl bromide per 1,000 cu. ft. for 2, 2½, and 3 hours, or to 3 lb. for 4 hours, and the standard treatment with hydrocyanic acid gas against *M. equestris* [**30** 488], all at 70°F. All the methyl-bromide treatments except 2 lb. for 2 hours stimulated the bulbs of *Lilium* to early growth to extents varying directly with the concentration, but by May there was little difference between plants subjected to the different schedules, except that only 70 per cent. of those fumigated with 3 lb. methyl bromide for 4 hours had developed. When the plants flowered in July and on comparing the weight of the harvested bulbs with those planted, the stimulative effect was again noticeable except for treatments with 3 lb. for 2½ hours or more, which had had an injurious effect by harvest time, the best results following fumigation with 2 lb. methyl bromide for 2½ hours. *Iris* bulbs were affected similarly, though to a lesser degree, but only the higher dosages produced any appreciable effect on *Narcissus*. Fumigation with hydrocyanic acid gas resulted in complete mortality of bulbs of *Lilium* and *Iris*.

Hamner (A. L.) & Lyle (C.). **How to line and fumigate Corn Cribs for Weevil Control.**—*Circ. Miss. agric. Exp. Sta.* no. 110, 6 pp., 4 figs. State College, Miss., 1943.

Since the loss of stored maize owing to infestation by the corn or rice weevil [*Calandra oryzae*, L.] and other pests, which amounts to 5 8 million bushels per year in Mississippi, may be cheaply prevented by fumigation in airtight storehouses, the authors describe a method of making the usual type of small store airtight by lining it with 15-lb. asphalted felt or cheap roofing. They recommend that the maize should be harvested as soon as it is mature and thoroughly dry and fumigated immediately after harvest and again in April or May; that carbon bisulphide, which is the cheapest and most effective fumigant for this purpose, should be used wherever there is no danger of fire; and that maize that is wet or not fully matured should not be put in a lined store, as it may mould and rot.

Tate (H. D.) & Whelan (D. B.). **Controlling stored-grain Pests on Nebraska Farms.**—*Circ. Neb. agric. Exp. Sta.* no. 74, 10 pp., 8 figs. Lincoln, Neb., 1943.

Brief notes are given on the appearance of the most important primary pests of stored grain in Nebraska and the damage they cause; and methods of preventing infestation, comprising keeping the grain cool and dry and storing only clean undamaged grain in clean bins, and of controlling it by means of the usual fumigants are described.

Linsley (E. G.) & Michelbacher (A. E.). **Insects affecting stored Food Products.**—*Bull. Calif. agric. Exp. Sta.* no. 676, 44 pp., 21 figs., 13 refs. Berkeley, Calif., 1943.

This account of the bionomics and control of the more important insects attacking stored food products in California deals mainly with those infesting foods that are kept in a dry state, especially cereals, pulses, nuts and dried fruits, most of the general household pests and those associated with meat, cheese, and moist or liquid foods being omitted. Ways in which the foods become infested are described, and notes on the appearance, importance, habits and control of the pests are followed by accounts of control measures, including sanitation, heat treatment, storage at low temperatures, spraying and fumigation.

Sherbakoff (C. D.) & Stanley (W. W.). **The more important Diseases and Insect Pests of Crops in Tennessee.**—*Bull. Tenn. agric. Exp. Sta.* no. 186, ix+142 pp., 94 figs., many refs. Knoxville, Tenn., 1943.

The authors give general recommendations for the control of diseases and insects attacking plants, and short accounts of the appearance, bionomics and control of those affecting the most important crops grown in Tennessee. They discuss soil management, the care of plant beds and seed treatment, mainly in relation to diseases, spraying and dusting, the injuriousness of spray residues and the biological control of insect pests.

Dugas (A. L.). **Recommendations for a Sugarcane Borer Control Program in Louisiana.**—*Bull. La agric. Exp. Sta.* no. 363, 14 pp., 6 figs. [Baton Rouge, La.] 1943.

None of the measures recommended against the sugar-cane borer [*Diatraea saccharalis*, F.] in Louisiana [*cf. R.A.E.*, A **30** 412] suffices to control it when used alone, and this bulletin contains, in addition to instructions for

applying them, indications of the factors that affect the selection of the combinations most suitable for use under various conditions. Control programmes should be carried out in all estates over as large an area as possible. Routine measures that should be adopted in all fields comprise the use of uninfested seed-cane, destroying the overwintering larvae by burning trash, etc., and shaving off and burning the summer-planted cane in winter, and reducing the numbers of larvae that enter hibernation by cutting the cane at or just below ground level and removing all millable cane and cane pieces from farm premises and the neighbourhood at harvest. Additional measures depend on the extent and severity of infestation. In general, infestation in any one field can be controlled by applying cryolite dusts against larvae of either the first or the second generation, but where infestation is light and suitable labour available, the removal of dead-hearts containing first-generation larvae may be more economic. Dusts are best applied against the first-generation larvae where the whole or a large part of the infested area is to be treated, and against the second generation where only part is to be treated. Dead-hearts can also be removed after dusts have been applied against the first-generation larvae, to destroy any that may have survived. Early maize in which heavy infestations of first-generation larvae are concentrated should be cut and fed to livestock or destroyed. Where dusts have not been used against the first generation and a heavy infestation subsequently develops over a large area, the second-generation can be controlled by means of dust applied by aeroplane. These measures should be supplemented by the liberation of *Trichogramma* [*minutum*, Ril.] against the second-generation eggs if the natural population of this parasite has not been so high as usual early in the season [but *cf.* **30** 117, 412].

BARTLETT (K. A.). **The Biology of *Metagonistylum minense* Tns., a Parasite of the Sugarcane Borer.**—*Bull. P. R.* [*fed.*] *Exp. Sta.* no. 40, 20 pp., 10 figs., 19 refs. Washington, D.C., 1941. [Recd. 1944.]

Much of the information in this bulletin on *Metagonistylum minense*, Tns., and its introduction into Porto Rico, where attempts have been made to establish two strains against *Diatraea saccharalis*, F., on sugar-cane [*R.A.E.*, A **28** 94, 651 ; **29** 470], has already been noticed. It contains an account of the bionomics of the parasite [*cf.* **27** 505], the methods used for rearing it in the laboratory [**28** 651], and its status in the Island in 1941 [**32** 342], together with reviews of its world distribution, host relationships, economic importance and parasites, none of which was observed in Porto Rico. The immature stages are described and descriptions of the adult are quoted.

BLICKLE (R. L.). **The relative Effects of falling, rising, and constant Concentrations of Sulfur Dioxide on the Confused Flour Beetle and the Granary Weevil.**—*Abstr. doct. Diss. Ohio Univ.* no. 40 pp. 17–20, 11 refs. Columbus, Ohio, 1943.

The author describes a method that was developed for obtaining and analysing data on the relative effectiveness of constant, increasing and decreasing concentrations of fumigants against insects, using sulphur dioxide as the fumigant, *Tribolium confusum*, Duv., and *Calandra* (*Sitophilus*) *granaria*, L., as the test insects, and a modification of an apparatus already noticed [*R.A.E.*, A **26** 21]. Although the differences were small, the results supported the validity of the method. Statistical analysis showed that the median lethal concentrations for *T. confusum* were lowest for decreasing concentrations and highest for increasing ones, indicating that the initial concentration had more effect on mortality than the final one. Possible reasons for this are discussed. The medial lethal concentrations for one hour's exposure to a constant concentration at 22±1°C. [71·6±1·8°F.] were 8·5 mg. per litre for *T. confusum* and 10·1 mg. per litre for *C. granaria*.

Some workers have been interested in the effect on insects of repeated applications of low concentrations of a fumigant (interval or tandem fumigation), which might injure plants less than a single fumigation with a higher concentration, and have discussed the effect of hydrocyanic acid gas used in this way [**21** 248 ; **24** 142 ; **28** 366]. In a few tests on *T. confusum* interval fumigations with sulphur dioxide appeared less effective than a single fumigation starting at high concentration.

GLEISSNER (B. D.). **Biology and Control of Berry Moth in the Erie Grape Belt with Notes on other Grape Insects.**—*Bull. Pa agric. Exp. Sta.* no. 451, 74 pp., 42 figs., 34 refs. State College, Pa., 1943.

The results are given of investigations during 1939–42 on *Polychrosis viteana*, Clem., in the Lake Erie Region, where it is a serious threat to the grape industry. The occurrence of two generations a year in some vineyards and three in others is discussed in some detail [*cf. R.A.E.*, A **30** 191], and it is shown that, though the type of soil affects the soil temperature and so the date of emergence of the overwintered generation, it is not the only factor, and that later emergence of moths of the two-brood type results from a difference in the extent of diapause in the two types of pupae. No external character differences were found between moths of the two types, and it is possible that they are environmentally conditioned to the diapause variation ; attempts to break the firm type of diapause in the two-generation type were unsuccessful.

The following is based on the author's summary. Moths are attracted to fermenting baits, an aqueous solution of 10 per cent. dark brown sugar being more attractive than the same concentration of black strap molasses. Additional attractants reduced the catch in spring, but the addition of 1 cc. eugenol, anethol or oil of sassafras per jar, increased mid-summer catches in the order named. The moths fly only at dusk and dawn, and there is a positive correlation between the intensities of their flight and egg laying. They do not fly at temperatures below 60°F., and the optimum temperature lies above 75°. There is a close correlation between the intensity of flight and the mean vineyard temperature between 8 and 10 p.m., and the temperature at dusk and dawn seems to be the greatest controlling factor of seasonal population level.

Attempts to trap the moths with light from several sources were unsuccessful in the vineyard, but laboratory observations indicated that moths are increasingly attracted with age and conditioning to light. Prevailing winds, topography and surrounding vegetation are the most important factors leading to concentrations of infestation within the vineyard. Light intensity may play a part, but observations indicated that protection of overwintering pupae by snow [*cf.* **30** 573] or concentration of cocoons spun on the foliage and blown against obstructions by wind were less important than the preference of the moths for sheltered positions. Special control efforts are required in these concentrated infestations.

The moths cannot survive more than three days without water, but live for about three weeks in the vineyard. Emerging females did not contain eggs, but those trapped three days later contained 21–110, some of which were fully matured. The egg stage, larval development and pupal stage last 2–14, 15–30 and 8–21 days, with mid-summer averages of about 4, 20 and 14 days, and there is a prepupal stage of 2–3 days. Larvae were reared in the insectary on apple in the normal time, but could not survive on pear fruits. Practically all larvae of the first generation spin cocoons on the foliage of grape vines, and approximately 90 per cent. of the autumn larvae go to the ground and spin cocoons within 15 ins. of the vines, the remainder doing so among the foliage. Moist leaves are necessary for successful cocoon formation, and this is favoured by lush weed and cover-crop growth in the vineyard. No larvae were observed to survive the winter, and 90 per cent. of larvae in grapes died when exposed to a temperature of 24°F. for about 14 hours. Pupae can survive undercooling

from 32 to −4°F. in 19 hours, and there is not much lower survival of pupae placed in escarpment vineyards than of those placed in lake-plain vineyards. Very cold winters, however, reduce the overwintering pupal population, though there seems to be a closer correlation between the weather of the crop season and the population level than between winter temperatures and infestation during the succeeding season.

A species of *Trichogramma* was the only egg parasite observed, and its numbers increased too slowly on eggs that appeared late in the season to have much influence on the abundance of the host; parasitism appeared to be greater in the more poorly cultivated areas, which possibly maintained early alternate hosts of the parasite. The larval parasites, *Omorgus* (*Campoplex*) *tortricidis*, Cushm., *Angitia* (*Inareolata*) *obliterata*, Cress., *Glypta mutica*, Cushm., *Ischnus polychrosidis*, Cushm., *Macrocentrus ancylivorus*, Rohw., and *Bracon* (*Microbracon*) *gelechiae*, Ashm., the pupal parasite, *Pimpla* (*Ephialtes*) *aequalis*, Prov., and the secondary parasites, *Hemiteles humeralis*, Prov., *H. tenellus*, Say, and a species of *Gelis* were reared from cocoons in 1940–43. Parasitism was greater on the early larvae, which webbed the blossoms, than on the later ones attacking the fruits. Predators, including Carabids, ants, Chrysopid larvae and spiders were probably of more importance than the parasites.

Different spray timings are required against larvae of the three- and two-brood types. Applications should be made at the pre-blossom and post-blossom stages, when the grapes nearly touch in the bunches, and, if necessary, 10 days later and in or soon after mid-August, where there are three generations, and at the post-blossom stage and 7–10 days later against the first generation, and once or more if necessary, beginning in late July or early August, against the second where there are two. Sprays of 3 lb. lead or calcium arsenate with a spreader in 100 U.S. gals. Bordeaux mixture were effective against the first generation, but could not be used in the later applications without leaving residues exceeding the legal tolerances. Lead arsenate gave better control than calcium arsenate, and both were better than basic copper arsenate. The ovicidal value of mineral-oil emulsions in the early arsenical sprays was demonstrated, but most of those commercially available do not wet the fruit sufficiently; a spreading type of supplement, such as resin fish-oil soap, proved necessary in sprays applied after the grapes attained much surface. The rapid expansion of the grapes for 3-4 weeks after they set has more influence than weathering in reducing the arsenical deposit. At about the time the grapes in the bunches touch, growth materially slackens, and this, although favourable from the standpoint of spray maintenance, prevents the use of arsenicals; the timing of the spray programme against the three-brood type permits the more efficient spraying for these reasons. Phenothiazine, fixed nicotines and nicotine sulphate with oil were tested against the second and third generations and were less effective than calcium arsenate. With the quantities stated per 100 U.S. gals. spray their approximate order of efficiency was 3 lb. micronised phenothiazine, 5 lb. bentonite with 1 U.S. pint nicotine sulphate and a spreader (tank-mix), 3 lb. micronised Black Leaf 155, 2 lb. micronised phenothiazine, 2 lb. micronised Black Leaf 155, 1 U.S. pint nicotine sulphate with 2 U.S. quarts oil, 3 lb. regular Black Leaf 155, and 3 lb. regular phenothiazine. The phenothiazines and micronised Black Leaf 155 are not commercially available in the United States at present.

Experiments on other vine insects showed that nicotine sulphate gave better control of *Erythroneura comes*, Say, than extracts of pyrethrum or pyrethrum and rotenone for the same cost. It should be used at the rate of 1 : 800 10 days after the grapes set or at 1 : 1,600 in two post-blossom sprays. The arsenical sprays recommended against *P. viteana* controlled *Fidia viticida*, Walsh, *Haltica* (*Altica*) *chalybea*, Ill., and other leaf-feeding insects. Spring cultural procedures to cover the overwintering cocoons of *P. viteana* with soil

and prevent heavy emergence are suggested, and spray schedules suitable for different types of infestation are appended.

HUGHES (J. H.). **The Alfalfa Plant Bug *Adelphocoris lineolatus* (Goeze) and other Miridae (Hemiptera) in Relation to Alfalfa-seed Production in Minnesota.**— *Tech. Bull. Minn. agric. Exp. Sta.* no. 161, 80 pp., 16 figs., 25 refs. [St. Paul, Minn.] 1943.

Adelphocoris lineolatus, Goeze, was first recorded in Minnesota in 1933 and was abundant on lucerne and sweet clover [*Melilotus*] throughout the State in 1939. The average annual yield of lucerne seed per acre was lower in 1930–42 than in 1919–29 and was declining between 1939 and 1942. Preliminary investigations begun in the autumn of 1939 showed that *A. lineolatus* was responsible for much injury to buds, flowers and pods, and observations were therefore made on its life-history, the nature of the injury it caused to the lucerne plant and possible methods of controlling it in lucerne fields.

The following is largely based on the author's summary. There are two generations in the year, and the winter is passed in the egg stage in the stems of lucerne. The eggs hatch in early May and the nymphs and adults feed on the buds, flowers and immature pods. Histological studies of flowers injured by *A. lineolatus* showed that cells near the feeding punctures, especially in the ovary and ovules, were affected. Necrosis of injured cells was localised round the feeding punctures at first, but later spread to other parts of the individual flower. Cell disintegration was obvious in the ovary and ovules 18 hours after Capsid feeding, and the injury was thought to be mainly phytotoxic, though there was a small amount of mechanical injury.

Several species of *Lygus*, particularly *L. oblineatus*, Say, are also common on lucerne in Minnesota ; they overwinter as adults and have many food-plants. *A. rapidus*, Say, which resembles *A. lineolatus* in life-history and habits, occurs on lucerne in very small numbers. Cage and field tests showed that these Capsids caused injury similar to that due to *A. lincolatus*, that all of them caused flower-fall, and that this damage is sufficient to account for the reduction of the seed crop. *A. lineolatus* was found to be more important than the other Capsids, and this is supported by the fact that, although *A. rapidus* and species of *Lygus* have been present in Minnesota for many years, reductions in seed yields were not reported generally until *A. lineolatus* had been introduced. Experiments also showed that approximately 35 per cent. of all flowers tripped, cross-pollinated and caged free from Capsids failed to set seed as a result of causes other than insects. In the field, the percentage of flower fall attributable to lack of tripping, lack of fertilisation and to other little-known causes would be higher still.

Cultural control methods were employed in some lucerne fields in northern Minnesota in 1942. It was found that thorough burning-over of lucerne fields in early spring before the Capsids became active considerably reduced the populations of *A. lineolatus*, *A. rapidus* and *Lygus*, and this was the most effective method of destroying the overwintering stages that was discovered. Where burning was not thorough, the Capsid population was reduced only slightly. Cultivation alone was less effective than burning; in fields that were both burnt over and cultivated the reduction increased with the thoroughness of the burning. Dusting sulphur, applied at 20, 25 or 30 lb. per acre to heavily infested half-acre plots when the lucerne was beginning to flower and again 4–6 days later, had practically no effect on the Capsids. A pyrethrum dust, applied similarly, caused 54·3–94·6 per cent. knockdown or kill of all species, but permitted rapid increases in population within 3–4 days, indicating that most of the insects were only temporarily affected, though some of the increase was due to migration from adjacent plots. Chemically treated plots showed no increase in yield of seed over untreated ones.

Michelbacher (A. E.), MacLeod (G. F.) & Smith (R. F.). **Control of *Diabrotica*, or Western Spotted Cucumber Beetle, in deciduous Fruit Orchards.**—*Bull. Calif. agric. Exp. Sta.* no. 681, 34 pp., 20 figs., 43 refs. Berkeley, Calif., 1943.

The following is mainly based on the authors' summary of this account of the results of investigations in 1941–42 on the bionomics of *Diabrotica undecimpunctata*, Mannh., carried out in view of the damage caused by the adults to stone fruits, and on its control in the orchards. A preliminary account of the early part of the study has already been noticed [*R.A.E.*, A **30** 357]. Prior to it, no worker had reared the insect through all its stages.

This Galerucid is mainly western in distribution and is one of the most destructive native insects in California. The eggs are laid round the bases of food-plants, just below the surface of the soil, and the larvae feed on the roots and construct earthen cells in which to pupate. They attack many kinds of crops, but the adults are more injurious, and are particularly so to cucurbits, beans, maize and other vegetable crops. There are probably three overlapping generations in the year in most of central California, and the winter is passed in the adult stage, although it is possible that all stages might be found during the colder months under some conditions. The first generation occurs largely in uncultivated regions and, unless there is sufficient rainfall to ensure a good growth of vegetation in the winter and early spring, is likely to be small. Adults of this generation are present from towards the end of April until the second half of June and may concentrate in large numbers on the floral parts of such plants as timothy grass [*Phleum pratense*] and *Anthemis cotula*. They migrate to cultivated plants as the wild ones dry up, and serious infestations in orchards are likely to occur only in years in which large populations develop in the uncultivated regions, and even then only in orchards adjacent to these regions. A 5 per cent. Pyrocide dust (0·1 per cent. pyrethrins) resulted in rather lower mortality than one containing pyrethrum and butyl carbitol thiocyanate [*cf.* **30** 358] but appeared to give equal protection to the fruit. In the laboratory at constant temperatures, development from egg to adult lasted 101 days at 60°F. and 27 days at 85°.

Reference is made to records of natural enemies in the literature. Those observed by the authors included spiders, rodents and the Tachinid, *Celatoria diabroticae*, Shim., which is a parasite of the adults but was rarely observed and is considered to be of little importance.

List (G. M.). **Psyllid Control on Potatoes and Tomatoes in the Victory Garden.**—*Bull. Colo. agric. Exp. Sta.* no. 479, 8 pp., 2 figs. Fort Collins, Colo., 1943.

This bulletin comprises notes on the appearance and bionomics of the potato and tomato Psyllid [*Paratrioza cockerelli*, Šulc], which causes psyllid yellows of the two plants, in Colorado [*cf.* *R.A.E.*, A **29** 21] and an account of methods of controlling it in gardens.

It is recommended that a well-agitated spray of 1 lb. wettable sulphur in 10 U.S. gals. water should be applied at the rate of about 1 U.S. gal. for 115 ft. of row, or 1 U.S. gal. for 75 ft. if the sprayer is small, or that dusting sulphur should be used at 1 lb. for 580 ft. of row or at 1 lb. per 300–400 ft. if the duster is small. In one test, potatoes with a medium to heavy infestation were effectively protected by dusting the sulphur through a double muslin cloth bag rather to the side of the plants when there was slight air movement to drive the dust through the foliage; this method took about 1 lb. sulphur for 250 ft. of row. When tomatos are transplanted, the tops should be dipped into wettable sulphur (1 lb. per 10 U.S. gals. water) if the plants have not previously been sprayed or dusted; they should be allowed to dry before being set. The first spray or dust should be applied about 10 days later, followed by additional

treatments every 7–10 days until the fruit is well formed; usually four are sufficient, even if infestation is heavy, but additional ones can be made if necessary without injuring the fruit. Potatoes should be treated when 4–6 ins. high, with three additional applications 7–10 days apart [*cf.* **29** 638]. Treatment should not be delayed until symptoms of psyllid yellows are seen, as it is then too late for complete protection.

SOCIETY OF AMERICAN FORESTERS. **Important Tree Pests of the Northeast. A Revision of Tree Pest Leaflets nos. 1–50.**—9 × 6 ins., 187 [+7] pp., 75 figs., refs. Boston, Mass. For. Park Ass., 1940. Price $1. [Recd. 1944.]

In view of increasing damage by insects and diseases to forest and shade trees in the north-eastern United States, a series of leaflets by various authors dealing with the different injurious agents was published, and the revised leaflets are here collected in one volume. Twenty-seven of them deal with insect pests, one with Tetranychid mites and one with the fungus (*Ceratostomella ulmi*) that causes Dutch elm disease and its Scolytid vectors. The information given in general comprises the history, distribution, rate of spread, bionomics and control of the species under consideration, together with descriptions of the various stages and of the injury caused by it. Brief notes on insecticides and on spraying and dusting equipment are given in a leaflet on the chemical control of insects and diseases, which also contains formulae for insecticidal and fungicidal sprays and dusts.

QUEENSLAND. **Annual Report of the Department of Agriculture and Stock for the Year 1942–43.**—28 pp. Brisbane, 1943.

The Report of the Director of Plant Industry (Research) by R. Veitch includes notes on entomological investigations (pp. 7–8). Work on the protection of stored potatoes against the potato tuber moth [*Gnorimoschema operculella*, Zell.] by means of dusts [*cf. R.A.E.*, A **31** 265, 325] was continued. Examination of treated tubers after three months showed that adequate control had been obtained with derris, magnesite or a mixture of pyridine and kaolin (1 : 19). Kieselguhr [infusorial earth] and kaolin were almost as effective, but sulphur, silica and dolomite were of little value. Dips gave very poor results. Derris, magnesite, pyridine and kieselguhr are all considered to show promise for use on a commercial scale; the first two leave less objectionable residues than the others.

Stored ground-nuts [*Arachis hypogaea*] are liable to infestation by the fig-moth [? *Ephestia cautella*, Wlk.] and the cadelle [*Tenebroides mauritanicus*, L.], and, if damaged, by the rust-red flour beetle [*Tribolium castaneum*, Hbst.], and the dried fruit beetle [*Carpophilus hemipterus*, L.]. Injury was reduced by covering the tops of the bins in which the ground-nuts were stored with hessian to exclude the insects, and less effectively by spraying the surface layer of ground-nuts with pyrethrum extract in oil at fortnightly or monthly intervals. The best results were obtained by combining the two methods, and the provision of permanent covers for the bins and the use of the spray during the summer are therefore recommended. Other precautionary measures comprise reducing the transfer of ground-nuts from one bin to another as much as possible, since this tends to break the shells and to introduce infestations into the centre of the bins; and the destruction of débris left in the bins when the ground-nuts are removed, which provides a medium in which breeding can continue, and of refuse from the shelling machines, which may disseminate infestation over the premises.

In work on the control of cotton pests, sprays were of no value against the corn ear worm [*Heliothis armigera*, Hb.] on irrigated cotton under the weather conditions prevailing at the time of the experiment. Yields from cotton in areas where irrigation is not necessary were greatly increased by eight applications of either sprays or dusts at weekly intervals when the treatment was begun at the beginning of the flowering period, but not when it was delayed until flowering was finished. The highest yields were obtained from early-planted cotton; those from late-planted cotton were doubled by weekly applications of dust from the beginning of the flowering period, but were still low.

Colonies of a Chinese race of a parasite [*Comperiella bifasciata*, How.] that was introduced into Australia from California [**32** 392] were liberated against the red scale [*Aonidiella aurantii*, Mask.] in several *Citrus* orchards in Queensland during the year.

Losses have occurred in recent years among trees in young plantations of hoop pine [*Araucaria cunninghami*]. The terminal growth dies back, and some trees 30 ft. high have died as a result. Several insects are associated with the condition and may contribute to it, but investigations indicate that they are not the initial cause.

Over 100 colonies of the lantana leaf-bug [*Teleonemia scrupulosa*, Stål] have been liberated in areas infested by *Lantana camara* along the coastal belt south of Townsville [**30** 155]. Until 1943, results were disappointing, but in that year a marked improvement, which is attributed to mild and somewhat wet weather in the winter of 1942, was noted in the status of colonies in several parts. In the district of Rockhampton, where a liberation was first made in 1937 [**30** 155], the Tingid was present on all *Lantana* inspected along a 50-mile stretch of highway between Rockhampton and Mount Larcom and within a 20-mile radius to the north-west and south-west of Rockhampton.

Butovitsch (V.). **Undersökning över en härjning av videspinnaren** (*Stilpnotia salicis* **L.) i Västra Uppland.** [An Investigation of an Outbreak of the Satin Moth (*S. salicis*) in West Uppland.]—*Medd. Skogsförsöksanst.* no. 33 pp. 267–294, 5 figs., 56 refs. Stockholm, 1944. (With a Summary in German.)

An outbreak of *Stilpnotia salicis*, L., occurred on aspen (*Populus tremula*) in two neighbouring forest areas in central Sweden in 1939–41, and the observations recorded in this paper were made during the second half of the period. Brief accounts are given of the distribution, morphology of all stages and previous outbreaks in Europe of this moth, together with lists of its food-plants and natural enemies in Europe and North America. The observations on its life-history are supplemented by material from the literature.

In 1940, the adults were on the wing in early July. The numbers of eggs laid per batch ranged from 113 to 260 and averaged 173. The larvae hatched in about a fortnight, fed on the leaves for about ten days and then spun winter shelters, in which they hibernated. In laboratory experiments, overwintering larvae could not be induced to resume feeding by warmth or light. In spring, the larvae fed on the young leaves, congregating on the trunks and branches to moult. Pupation occurred in June, and the adults emerged 9–12 days later.

The only parasite observed was a Scelionid, probably *Telenomus mayri*, Kieff., which parasitised 65·6 per cent. of the eggs in July 1940 and is thought to have been a major factor in the collapse of the outbreak.

Observations on the effect on the trees of the defoliation caused showed that most of the bare trees put forth new leaves after about seven weeks, but that about 12 per cent. failed to do so and eventually died. It is estimated that about 20 per cent. of the trees over the whole area were killed by the outbreak.

NOTICES.

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